# Computer Algebra Independent Integration Tests

Summer 2023 edition with Rubi V 4.17.3

4-Trig-functions/4.1-Sine/68-4.1.11-e-x-^m-a+b-x^n-^p-sin

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# Contents

# CHAPTER 1

## Introduction

This report gives the result of running the computer algebra independent integration test.The download section in on the main webpage contains links to download the problems in plain text format used for all CAS systems. The number of integrals in this report is [ 113 ]. This is test number [ 68 ].

## 1.1 Listing of CAS systems tested

The following are the CAS systems tested:

1. Mathematica 13.3.1 (August 16, 2023) on windows 10.
2. Rubi 4.17.3 (Sept 25, 2023) on Mathematica 13.3.1 on windows 10
3. Maple 2023.1 (July, 12, 2023) on windows 10.
4. Maxima 5.47 (June 1, 2023) using Lisp SBCL 2.3.0 on Linux via sagemath 10.1 (Aug 20, 2023).
5. FriCAS 1.3.9 (July 8, 2023) based on sbcl 2.3.0 on Linux via sagemath 10.1 (Aug 20, 2023).
6. Giac/Xcas 1.9.0-57 (June 26, 2023) on Linux via sagemath 10.1 (Aug 20, 2023).
7. Sympy 1.12 (May 10, 2023) Using Python 3.11.3 on Linux.
8. Mupad using Matlab 2021a with Symbolic Math Toolbox Version 8.7 on windows 10.

Maxima and Fricas and Giac are called using Sagemath. This was done using Sagemath `integrate` command by changing the name of the algorithm to use the different CAS systems.

Sympy was run directly in Python not via sagemath.

## 1.2 Results

Important note: A number of problems in this test suite have no antiderivative in closed form. This means the antiderivative of these integrals can not be expressed in terms of elementary, special functions or `Hypergeometric2F1` functions. `RootSum` and `RootOf` are not allowed. If a CAS returns the above integral unevaluated within the time limit, then the result is counted as passed and assigned an A grade.

However, if CAS times out, then it is assigned an F grade even if the integral is not integrable, as this implies CAS could not determine that the integral is not integrable in the time limit.

If a CAS returns an antiderivative to such an integral, it is assigned an A grade automatically and this special result is listed in the introduction section of each individual test report to make it easy to identify as this can be important result to investigate.

The results given in in the table below reflects the above.

| System | % solved | % Failed |
|---|---|---|
| Rubi | 100.00 ( 113 ) | 0.00 ( 0 ) |
| Mathematica | 100.00 ( 113 ) | 0.00 ( 0 ) |
| Maple | 100.00 ( 113 ) | 0.00 ( 0 ) |
| Fricas | 100.00 ( 113 ) | 0.00 ( 0 ) |
| Giac | 62.83 ( 71 ) | 37.17 ( 42 ) |
| Maxima | 46.90 ( 53 ) | 53.10 ( 60 ) |
| Sympy | 23.01 ( 26 ) | 76.99 ( 87 ) |
| Mupad | 17.70 ( 20 ) | 82.30 ( 93 ) |

Table 1.1: Percentage solved for each CAS

The table below gives additional break down of the grading of quality of the antiderivatives generated by each CAS. The grading is given using the letters A,B,C and F with A being the best quality. The grading is accomplished by comparing the antiderivative generated with the optimal antiderivatives included in the test suite. The following table describes the meaning of these grades.

| grade | description |
|---|---|
| A | Integral was solved and antiderivative is optimal in quality and leaf size. |
| B | Integral was solved and antiderivative is optimal in quality but leaf size is larger than twice the optimal antiderivatives leaf size. |
| C | Integral was solved and antiderivative is non-optimal in quality. This can be due to one or more of the following reasons<br>1. antiderivative contains a hypergeometric function and the optimal antiderivative does not.<br>2. antiderivative contains a special function and the optimal antiderivative does not.<br>3. antiderivative contains the imaginary unit and the optimal antiderivative does not. |
| F | Integral was not solved. Either the integral was returned unevaluated within the time limit, or it timed out, or CAS hanged or crashed or an exception was raised. |

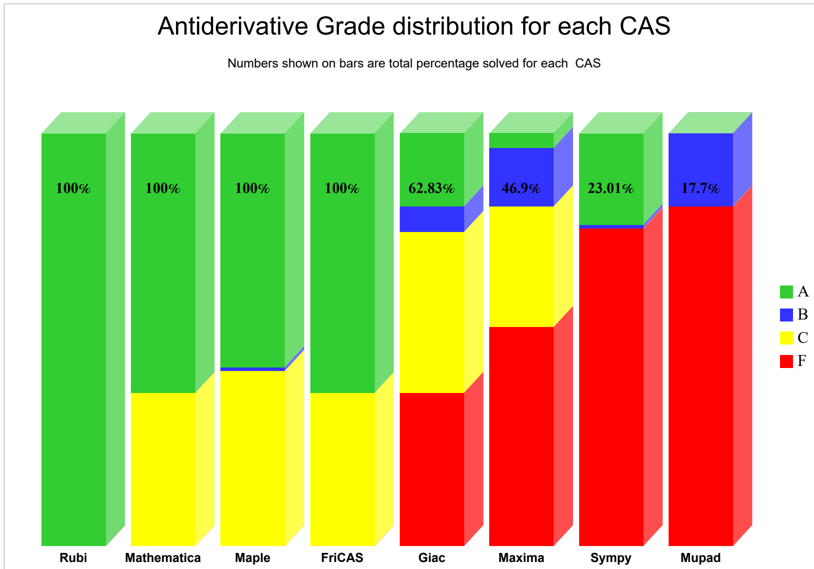
Table 1.2: Description of grading applied to integration result

Grading is implemented for all CAS systems. Based on the above, the following table summarizes the grading for this test suite.

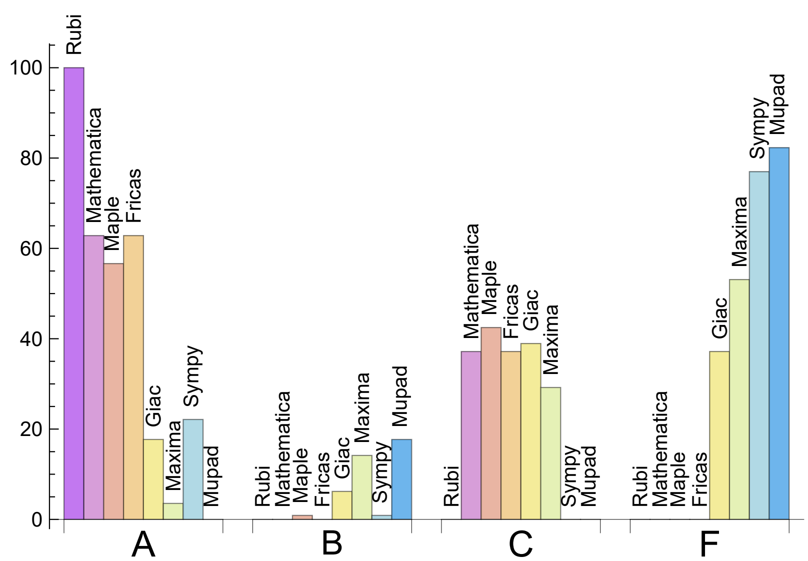
| System | % A grade | % B grade | % C grade | % F grade |
|---|---|---|---|---|
| Rubi | 99.115 | 0.885 | 0.000 | 0.000 |
| Mathematica | 62.832 | 0.000 | 37.168 | 0.000 |
| Fricas | 62.832 | 0.000 | 37.168 | 0.000 |
| Maple | 56.637 | 0.885 | 42.478 | 0.000 |
| Sympy | 22.124 | 0.885 | 0.000 | 76.991 |
| Giac | 17.699 | 6.195 | 38.938 | 37.168 |
| Maxima | 3.540 | 14.159 | 29.204 | 53.097 |
| Mupad | 0.000 | 17.699 | 0.000 | 82.301 |

Table 1.3: Antiderivative Grade distribution of each CAS

The following is a Bar chart illustration of the data in the above table.




The figure below compares the grades of the CAS systems.




The following table shows the distribution of the different types of failures for each CAS. There are 3 types failures. The first is when CAS returns the input within the time limit, which means it could not solve it. This is the typical failure and given as **F**.

The second failure is due to time out. CAS could not solve the integral within the 3 minutes time limit which is assigned. This is assigned **F(-1)**.

The third is due to an exception generated, indicated as **F(-2)**. This most likely indicates an interface problem between sagemath and the CAS (applicable only to FriCAS, Maxima and Giac) or it could be an indication of an internal error in the CAS itself. This type of error requires more investigation to determine the cause.

| System | Number failed | Percentage normal failure | Percentage timeout failure | Percentage exception failure |
|---|---|---|---|---|
| Rubi | 0 | 0.00 | 0.00 | 0.00 |
| Mathematica | 0 | 0.00 | 0.00 | 0.00 |
| Fricas | 0 | 0.00 | 0.00 | 0.00 |
| Maple | 0 | 0.00 | 0.00 | 0.00 |
| Giac | 42 | 100.00 | 0.00 | 0.00 |
| Maxima | 60 | 100.00 | 0.00 | 0.00 |
| Sympy | 87 | 80.46 | 19.54 | 0.00 |
| Mupad | 93 | 0.00 | 100.00 | 0.00 |

Table 1.4: Failure statistics for each CAS

## 1.3 Time and leaf size Performance

The table below summarizes the performance of each CAS system in terms of time used and leaf size of results.

Mean size is the average leaf size produced by the CAS (before any normalization). The Normalized mean is relative to the mean size of the optimal anti-derivative given in the input files.

For example, if CAS has **Normalized mean** of 3, then the mean size of its leaf size is 3 times as large as the mean size of the optimal leaf size.

Median size is value of leaf size where half the values are larger than this and half are smaller (before any normalization). i.e. The Middle value.

Similarly the **Normalized median** is relative to the median leaf size of the optimal.

For example, if a CAS has Normalized median of 1.2, then its median is 1.2 as large as the median leaf size of the optimal.

| System | Mean time (sec) |
|---|---|
| Fricas | 0.30 |
| Giac | 0.34 |
| Maple | 0.42 |
| Mathematica | 0.70 |
| Rubi | 0.83 |
| Sympy | 0.84 |
| Maxima | 1.11 |
| Mupad | 3.27 |

Table 1.5: Time performance for each CAS

| System | Mean size | Normalized mean | Median size | Normalized median |
|---|---|---|---|---|
| Mupad | 116.40 | 0.98 | 119.50 | 0.95 |
| Sympy | 144.08 | 1.32 | 142.50 | 1.23 |
| Mathematica | 214.36 | 0.82 | 145.00 | 0.77 |
| Maxima | 249.96 | 2.85 | 164.00 | 1.80 |
| Fricas | 274.20 | 0.97 | 161.00 | 0.94 |
| Maple | 287.56 | 1.15 | 180.00 | 1.06 |
| Rubi | 321.51 | 1.05 | 181.00 | 1.00 |
| Giac | 2408.20 | 13.30 | 834.00 | 8.14 |

Table 1.6: Leaf size performance for each CAS

## 1.4 Performance based on number of rules Rubi used

This section shows how each CAS performed based on the number of rules Rubi needed to solve the same integral. One diagram is given for each CAS.

On the $y$ axis is the percentage solved which Rubi itself needed the number of rules given the $x$ axis. These plots show that as more rules are needed then most CAS system percentage of solving decreases which indicates the integral is becoming more complicated to solve.

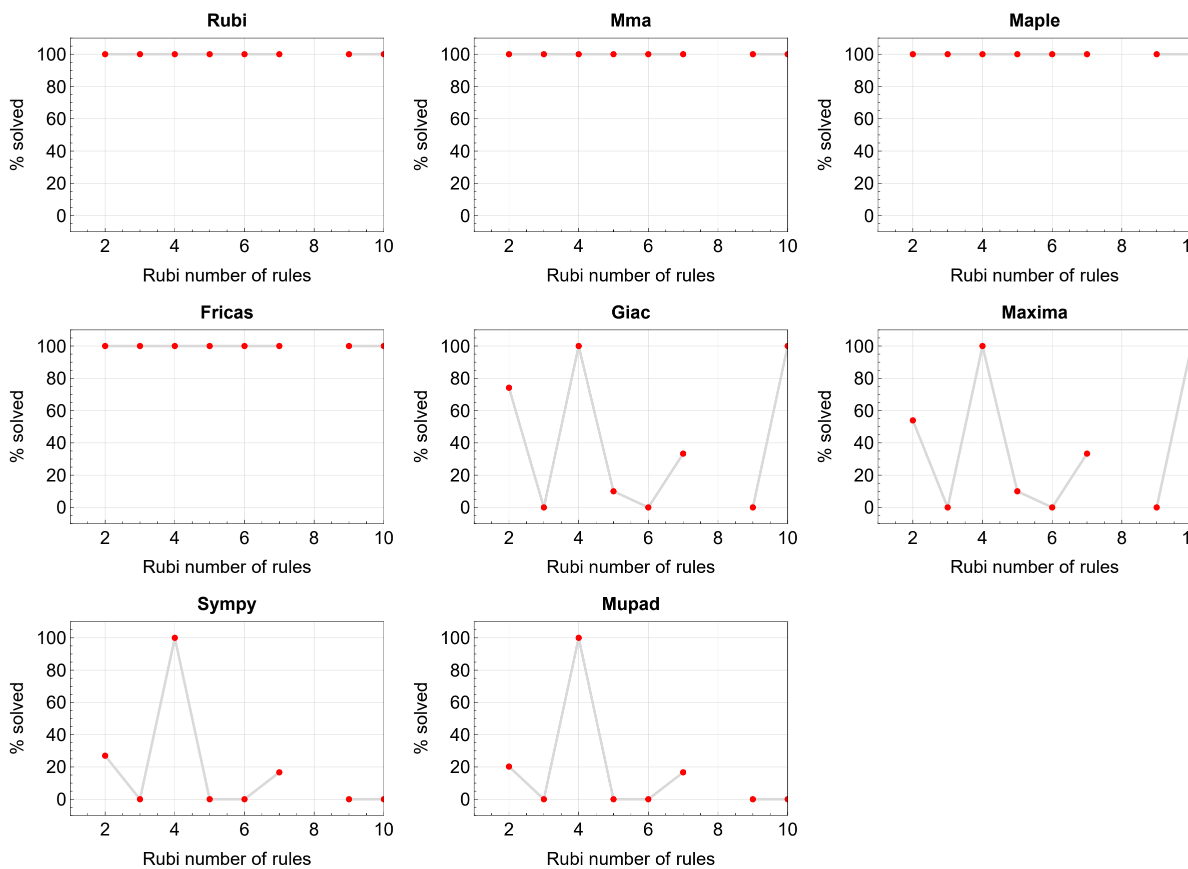



Figure 1.1: Solving statistics per number of Rubi rules used

## 1.5 Performance based on number of steps Rubi used

This section shows how each CAS performed based on the number of steps Rubi needed to solve the same integral. Note that the number of steps Rubi needed can be much higher than the number of rules, as the same rule could be used more than once.

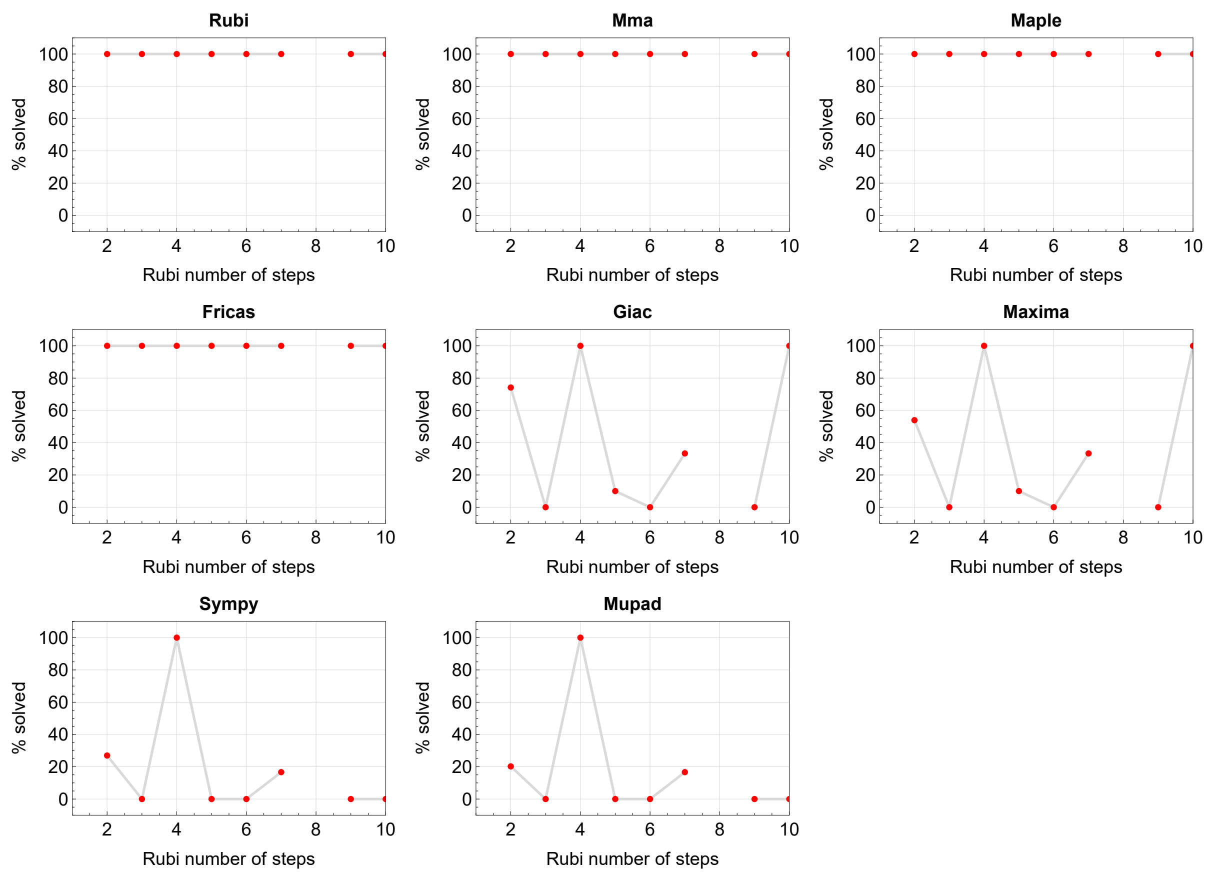



Figure 1.2: Solving statistics per number of Rubi steps used

The above diagram show that the precentage of solved intergals decreases for most CAS systems as the number of steps increases. As expected, for integrals that required less steps by Rubi, CAS systems had more success which indicates the integral was not as hard to solve. As Rubi needed more steps to solve the integral, the solved percentage decreased for most CAS systems which indicates the integral is becoming harder to solve.

## 1.6 Solved integrals histogram based on leaf size of result

The following shows the distribution of solved integrals for each CAS system based on leaf size of the antiderivatives produced by each CAS. It shows that most integrals solved produced leaf size less than about 100 to 150. The bin size used is 40.

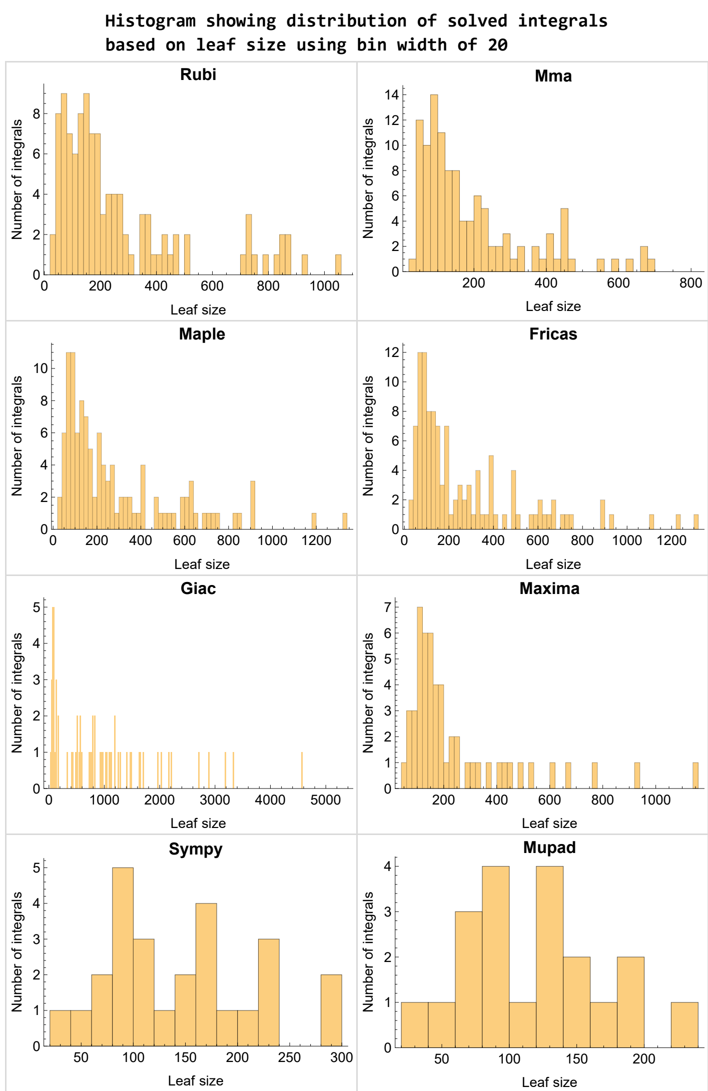



Figure 1.3: Solved integrals based on leaf size distribution

## 1.7 Solved integrals histogram based on CPU time used

The following shows the distribution of solved integrals for each CAS system based on CPU time used in seconds. The bin size used is 0.1 second.

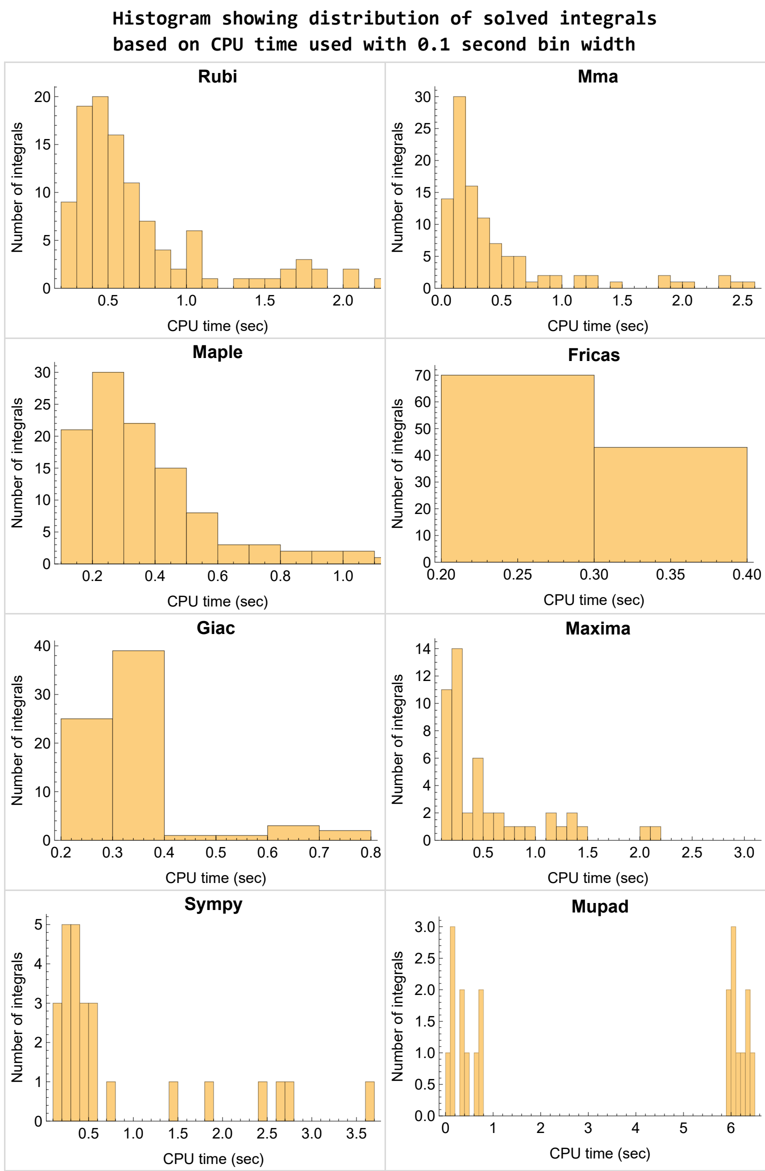



Figure 1.4: Solved integrals histogram based on CPU time used

## 1.8 Leaf size vs. CPU time used

The following gives the relation between the CPU time used to solve an integral and the leaf size of the antiderivative.

The result for Fricas, Maxima and Giac is shifted more to the right than the other CAS system due to the use of sagemath to call them, which causes an initial slight delay in the timing to start the integration due to overhead of starting a new process each time.

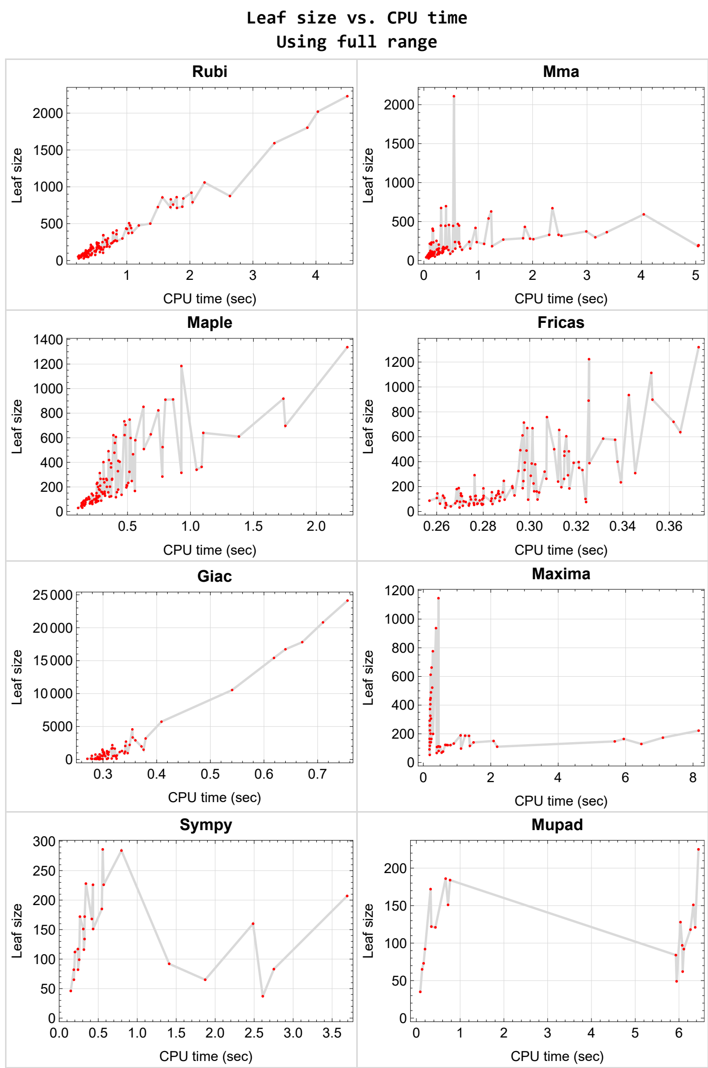



Figure 1.5: Leaf size vs. CPU time. Full range

## 1.9 list of integrals with no known antiderivative

{}

## 1.10 List of integrals solved by CAS but has no known antiderivative

**Rubi** {}

**Mathematica** {}

**Maple** {}

**Maxima** {}

**Fricas** {}

**Sympy** {}

**Giac** {}

**Mupad** {}

## 1.11 list of integrals solved by CAS but failed verification

The following are integrals solved by CAS but the verification phase failed to verify the anti-derivative produced is correct. This does not necessarily mean that the anti-derivative is wrong as additional methods of verification might be needed, or more time is needed (3 minutes time limit was used). These integrals are listed here to make it possible to do further investigation to determine why the result could not be verified.

**Rubi** {}

**Mathematica** {111}

**Maple** {18, 83, 90, 91}

**Maxima** Verification phase not currently implemented.

**Fricas** Verification phase not currently implemented.

**Sympy** Verification phase not currently implemented.

**Giac** Verification phase not currently implemented.

**Mupad** Verification phase not currently implemented.

## 1.12 Timing

The command `AbsoluteTiming[]` was used in Mathematica to obtain the elapsed time for each integrate call. In Maple, the command `Usage` was used as in the following example

```
cpu_time := Usage(assign ('result_of_int',int(expr,x)),output='realtime'
```

For all other CAS systems, the elapsed time to complete each integral was found by taking the difference between the time after the call completed from the time before the call was made. This was done using Python's `time.time()` call.

All elapsed times shown are in seconds. A time limit of 3 CPU minutes was used for each integral. If the integrate command did not complete within this time limit, the integral was aborted and considered to have failed and assigned an F grade. The time used by failed integrals due to time out was not counted in the final statistics.

## 1.13 Verification

A verification phase was applied on the result of integration for `Rubi` and `Mathematica`.

Future version of this report will implement verification for the other CAS systems. For the integrals whose result was not run through a verification phase, it is assumed that the antiderivative was correct.

Verification phase also had 3 minutes time out. An integral whose result was not verified could still be correct, but further investigation is needed on those integrals. These integrals were marked in the summary table below and also in each integral separate section so they are easy to identify and locate.

## 1.14 Important notes about some of the results

### 1.14.1 Important note about Maxima results

Since tests were run in a batch mode, and using an automated script, then any integral where Maxima needed an interactive response from the user to answer a question during the evaluation of the integral will fail.

The exception raised is `ValueError`. Therefore Maxima results is lower than what would result if Maxima was run directly and each question was answered correctly.

The percentage of such failures were not counted for each test file, but for an example, for the `Timofeev` test file, there were about 14 such integrals out of total 705, or about 2 percent. This percentage can be higher or lower depending on the specific input test file.

Such integrals can be identified by looking at the output of the integration in each section for Maxima. The exception message will indicate the cause of error.

Maxima integrate was run using SageMath with the following settings set by default

```
'besselexpand : true'
'display2d : false'
'domain : complex'
'keepfloat : true'
'load(to_poly_solve)'
'load(simplify_sum)'
'load(abs_integrate)' 'load(diag)'
```

SageMath automatic loading of Maxima `abs_integrate` was found to cause some problems. So the following code was added to disable this effect.

```
from sage.interfaces.maxima_lib import maxima_lib
maxima_lib.set('extra_definite_integration_methods', '[]')
maxima_lib.set('extra_integration_methods', '[]')
```

See `https://ask.sagemath.org/question/43088/integrate-results-that-are-different-from-using-maxima/` for reference.

### 1.14.2 Important note about FriCAS result

There were few integrals which failed due to SageMath interface and not because FriCAS system could not do the integration.

These will fail With error `Exception raised: NotImplementedError`.

The number of such cases seems to be very small. About 1 or 2 percent of all integrals. These can be identified by looking at the exception message given in the result.

### 1.14.3 Important note about finding leaf size of antiderivative

For Mathematica, Rubi, and Maple, the builtin system function `LeafSize` was used to find the leaf size of each antiderivative.

The other CAS systems (SageMath and Sympy) do not have special builtin function for this purpose at this time. Therefore the leaf size for Fricas and Sympy antiderivative was determined using the following function, thanks to user `slelievre` at `https://ask.sagemath.org/question/57123/could-we-have-a-leaf_count-function-in-base-sagemath/`

```
def tree_size(expr):
   r"""
   Return the tree size of this expression.
   """
   if expr not in SR:
      # deal with lists, tuples, vectors
      return 1 + sum(tree_size(a) for a in expr)
   expr = SR(expr)
   x, aa = expr.operator(), expr.operands()
   if x is None:
      return 1
   else:
      return 1 + sum(tree_size(a) for a in aa)
```

For Sympy, which was called directly from Python, the following code was used to obtain the leafsize of its result

```
try:
  # 1.7 is a fudge factor since it is low side from actual leaf count
  leafCount = round(1.7*count_ops(anti))

  except Exception as ee:
       leafCount =1
```

### 1.14.4 Important note about Mupad results

Matlab's symbolic toolbox does not have a leaf count function to measure the size of the antiderivative. Maple was used to determine the leaf size of Mupad output by post processing Mupad result.

Currently no grading of the antiderivative for Mupad is implemented. If it can integrate the problem, it was assigned a B grade automatically as a placeholder. In the future, when grading function is implemented for Mupad, the tests will be rerun again.

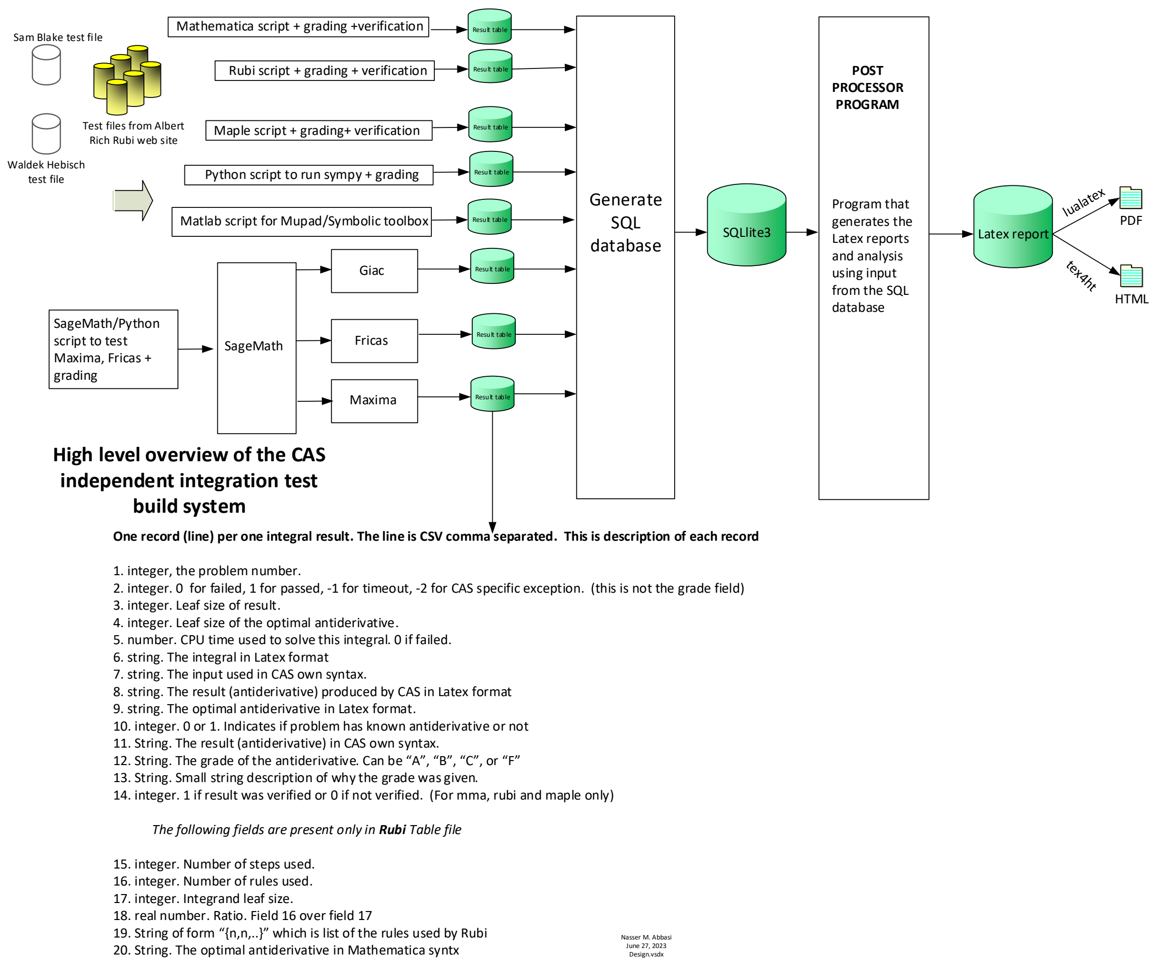
The following is an example of using Matlab's symbolic toolbox (Mupad) to solve an integral

```
integrand = evalin(symengine,'cos(x)*sin(x)')
the_variable = evalin(symengine,'x')
anti = int(integrand,the_variable)
```

Which gives `sin(x)^2/2`

# 1.15 Design of the test system

The following diagram gives a high level view of the current test build system.



# CHAPTER 2

## DETAILED SUMMARY TABLES OF RESULTS

## 2.1 List of integrals sorted by grade for each CAS



### 2.1.1 Rubi

**A grade** { 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58, 59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78, 79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98, 99, 100, 101, 102, 103, 104, 105, 106, 107, 108, 110, 111, 112, 113 }

**B grade** { 109 }

**C grade** { }

**F normal fail** { }

**F(-1) timedout fail** { }

**F(-2) exception fail** { }

### 2.1.2 Mma

**A grade** { 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93 }

**B grade** { }

**C grade** { 57, 58, 59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78, 94, 95, 96, 97, 98, 99, 100, 101, 102, 103, 104, 105, 106, 107, 108, 109, 110, 111, 112, 113 }

**F normal fail** { }

**F(-1) timedout fail** { }

**F(-2) exception fail** { }

### 2.1.3 Maple

**A grade** { 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 22, 23, 24, 25, 30, 31, 32, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 53, 54, 55, 56, 61, 62, 63, 64, 69, 70, 75, 76, 78, 79, 80, 81, 82, 84, 85, 86, 87, 88, 92, 93 }

**B grade** { 35 }

**C grade** { 18, 19, 20, 21, 26, 27, 28, 29, 33, 34, 52, 57, 58, 59, 60, 65, 66, 67, 68, 71, 72, 73, 74, 77, 83, 89, 90, 91, 94, 95, 96, 97, 98, 99, 100, 101, 102, 103, 104, 105, 106, 107, 108, 109, 110, 111, 112, 113 }

**F normal fail** { }

**F(-1) timedout fail** { }

**F(-2) exception fail** { }

### 2.1.4 Fricas

**A grade** { 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93 }

**B grade** { }

**C grade** { 57, 58, 59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78, 94, 95, 96, 97, 98, 99, 100, 101, 102, 103, 104, 105, 106, 107, 108, 109, 110, 111, 112, 113 }

**F normal fail** { }

**F(-1) timedout fail** { }

**F(-2) exception fail** { }

### 2.1.5 Maxima

**A grade** { 3, 4, 11, 43 }

**B grade** { 1, 2, 10, 12, 40, 41, 42, 49, 50, 51, 79, 80, 81, 82, 87, 88 }

**C grade** { 5, 6, 7, 8, 9, 13, 14, 15, 16, 17, 21, 22, 30, 36, 44, 45, 46, 47, 48, 52, 53, 54, 55, 56, 83, 84, 85, 86, 89, 90, 91, 92, 93 }

**F normal fail** { 18, 19, 20, 23, 24, 25, 26, 27, 28, 29, 31, 32, 33, 34, 35, 37, 38, 39, 57, 58, 59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78, 94, 95, 96, 97, 98, 99, 100, 101, 102, 103, 104, 105, 106, 107, 108, 109, 110, 111, 112, 113 }

**F(-1) timedout fail** { }

**F(-2) exception fail** { }

### 2.1.6 Giac

**A grade** { 1, 2, 3, 4, 10, 11, 12, 40, 41, 42, 43, 49, 50, 51, 79, 80, 81, 82, 87, 88 }

**B grade** { 26, 27, 28, 29, 30, 31, 32 }

**C grade** { 5, 6, 7, 8, 9, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 33, 34, 35, 36, 37, 38, 39, 44, 45, 46, 47, 48, 52, 53, 54, 55, 56, 83, 84, 85, 86, 89, 90, 91, 92, 93 }

**F normal fail** { 57, 58, 59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78, 94, 95, 96, 97, 98, 99, 100, 101, 102, 103, 104, 105, 106, 107, 108, 109, 110, 111, 112, 113 }

**F(-1) timedout fail** { }

**F(-2) exception fail** { }

### 2.1.7 Mupad

**A grade** { }

**B grade** { 1, 2, 3, 4, 10, 11, 12, 40, 41, 42, 43, 49, 50, 51, 79, 80, 81, 82, 87, 88 }

**C grade** { }

**F normal fail** { }

**F(-1) timedout fail** { 5, 6, 7, 8, 9, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 44, 45, 46, 47, 48, 52, 53, 54, 55, 56, 57, 58, 59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78, 83, 84, 85, 86, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98, 99, 100, 101, 102, 103, 104, 105, 106, 107, 108, 109, 110, 111, 112, 113 }

**F(-2) exception fail** { }

### 2.1.8 Sympy

**A grade** { 1, 2, 3, 4, 5, 10, 11, 13, 40, 41, 42, 43, 44, 49, 50, 51, 52, 79, 80, 81, 82, 83, 87, 88, 89 }

**B grade** { 12 }

**C grade** { }

**F normal fail** { 6, 7, 8, 9, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 45, 46, 47, 48, 53, 54, 55, 56, 57, 58, 59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 76, 84, 85, 86, 90, 91, 92, 93, 94, 95, 96, 97, 98, 99, 100, 101, 106 }

**F(-1) timedout fail** { 72, 73, 74, 75, 77, 78, 102, 103, 104, 105, 107, 108, 109, 110, 111, 112, 113 }

**F(-2) exception fail** { }

## 2.2 Detailed conclusion table per each integral for all CAS systems

Detailed conclusion table per each integral is given by the table below. The elapsed time is in seconds. For failed result it is given as **F(-1)** if the failure was due to timeout. It is given as **F(-2)** if the failure was due to an exception being raised, which could indicate a bug in the system. If the failure was due to integral not being evaluated within the time limit, then it is given as **F**.

In this table, the column `N.S.` means **normalized size** and is defined as $\frac{\text{antiderivative leaf size}}{\text{optimal antiderivative leaf size}}$. To make the table fit the page, the name `Mathematica` was abbreviated to `MMA`.

| Problem 1 | Optimal | Rubi | MMA | Maple | Maxima | Fricas | Sympy | Giac | Mupad |
|---|---|---|---|---|---|---|---|---|---|
| grade | N/A | A | A | A | B | A | A | A | B |
| verified | N/A | Yes | Yes | Yes | TBD | TBD | TBD | TBD | TBD |
| size | 126 | 126 | 82 | 85 | 306 | 85 | 151 | 86 | 122 |
| N.S. | 1 | 1.00 | 0.65 | 0.67 | 2.43 | 0.67 | 1.20 | 0.68 | 0.97 |
| time (sec) | N/A | 0.464 | 0.151 | 0.164 | 0.227 | 0.287 | 0.309 | 0.288 | 0.343 |

| Problem 2 | Optimal | Rubi | MMA | Maple | Maxima | Fricas | Sympy | Giac | Mupad |
|---|---|---|---|---|---|---|---|---|---|
| grade | N/A | A | A | A | B | A | A | A | B |
| verified | N/A | Yes | Yes | Yes | TBD | TBD | TBD | TBD | TBD |
| size | 96 | 96 | 65 | 67 | 201 | 67 | 117 | 68 | 92 |
| N.S. | 1 | 1.00 | 0.68 | 0.70 | 2.09 | 0.70 | 1.22 | 0.71 | 0.96 |
| time (sec) | N/A | 0.387 | 0.129 | 0.145 | 0.212 | 0.276 | 0.239 | 0.285 | 0.198 |

| Problem 3 | Optimal | Rubi | MMA | Maple | Maxima | Fricas | Sympy | Giac | Mupad |
|---|---|---|---|---|---|---|---|---|---|
| grade | N/A | A | A | A | A | A | A | A | B |
| verified | N/A | Yes | Yes | Yes | TBD | TBD | TBD | TBD | TBD |
| size | 65 | 65 | 45 | 47 | 117 | 48 | 82 | 49 | 62 |
| N.S. | 1 | 1.00 | 0.69 | 0.72 | 1.80 | 0.74 | 1.26 | 0.75 | 0.95 |
| time (sec) | N/A | 0.288 | 0.109 | 0.136 | 0.192 | 0.274 | 0.187 | 0.291 | 6.084 |

| Problem 4 | Optimal | Rubi | MMA | Maple | Maxima | Fricas | Sympy | Giac | Mupad |
|---|---|---|---|---|---|---|---|---|---|
| grade | N/A | A | A | A | A | A | A | A | B |
| verified | N/A | Yes | Yes | Yes | TBD | TBD | TBD | TBD | TBD |
| size | 28 | 28 | 27 | 29 | 53 | 30 | 46 | 31 | 35 |
| N.S. | 1 | 1.00 | 0.96 | 1.04 | 1.89 | 1.07 | 1.64 | 1.11 | 1.25 |
| time (sec) | N/A | 0.223 | 0.089 | 0.108 | 0.190 | 0.264 | 0.148 | 0.294 | 0.090 |

| Problem 5 | Optimal | Rubi | MMA | Maple | Maxima | Fricas | Sympy | Giac | Mupad |
|---|---|---|---|---|---|---|---|---|---|
| grade | N/A | A | A | A | C | A | A | C | F(-1) |
| verified | N/A | Yes | Yes | Yes | TBD | TBD | TBD | TBD | TBD |
| size | 29 | 29 | 40 | 31 | 522 | 32 | 37 | 339 | 0 |
| N.S. | 1 | 1.00 | 1.38 | 1.07 | 18.00 | 1.10 | 1.28 | 11.69 | 0.00 |
| time (sec) | N/A | 0.304 | 0.069 | 0.141 | 0.263 | 0.270 | 2.611 | 0.294 | 0.000 |

| Problem 6 | Optimal | Rubi | MMA | Maple | Maxima | Fricas | Sympy | Giac | Mupad |
|---|---|---|---|---|---|---|---|---|---|
| grade | N/A | A | A | A | C | A | F | C | F(-1) |
| verified | N/A | Yes | Yes | Yes | TBD | TBD | TBD | TBD | TBD |
| size | 48 | 48 | 60 | 56 | 108 | 54 | 0 | 569 | 0 |
| N.S. | 1 | 1.00 | 1.25 | 1.17 | 2.25 | 1.12 | 0.00 | 11.85 | 0.00 |
| time (sec) | N/A | 0.374 | 0.150 | 0.153 | 0.404 | 0.280 | 0.000 | 0.297 | 0.000 |

| Problem 7 | Optimal | Rubi | MMA | Maple | Maxima | Fricas | Sympy | Giac | Mupad |
|---|---|---|---|---|---|---|---|---|---|
| grade | N/A | A | A | A | C | A | F | C | F(-1) |
| verified | N/A | Yes | Yes | Yes | TBD | TBD | TBD | TBD | TBD |
| size | 89 | 89 | 76 | 88 | 112 | 83 | 0 | 796 | 0 |
| N.S. | 1 | 1.00 | 0.85 | 0.99 | 1.26 | 0.93 | 0.00 | 8.94 | 0.00 |
| time (sec) | N/A | 0.431 | 0.245 | 0.163 | 0.439 | 0.269 | 0.000 | 0.302 | 0.000 |

| Problem 8 | Optimal | Rubi | MMA | Maple | Maxima | Fricas | Sympy | Giac | Mupad |
|---|---|---|---|---|---|---|---|---|---|
| grade | N/A | A | A | A | C | A | F | C | F(-1) |
| verified | N/A | Yes | Yes | Yes | TBD | TBD | TBD | TBD | TBD |
| size | 132 | 132 | 110 | 117 | 111 | 108 | 0 | 961 | 0 |
| N.S. | 1 | 1.00 | 0.83 | 0.89 | 0.84 | 0.82 | 0.00 | 7.28 | 0.00 |
| time (sec) | N/A | 0.480 | 0.289 | 0.192 | 0.460 | 0.260 | 0.000 | 0.308 | 0.000 |

| Problem 9 | Optimal | Rubi | MMA | Maple | Maxima | Fricas | Sympy | Giac | Mupad |
|---|---|---|---|---|---|---|---|---|---|
| grade | N/A | A | A | A | C | A | F | C | F(-1) |
| verified | N/A | Yes | Yes | Yes | TBD | TBD | TBD | TBD | TBD |
| size | 166 | 166 | 138 | 145 | 110 | 124 | 0 | 1108 | 0 |
| N.S. | 1 | 1.00 | 0.83 | 0.87 | 0.66 | 0.75 | 0.00 | 6.67 | 0.00 |
| time (sec) | N/A | 0.533 | 0.242 | 0.216 | 0.495 | 0.271 | 0.000 | 0.311 | 0.000 |

| Problem 10 | Optimal | Rubi | MMA | Maple | Maxima | Fricas | Sympy | Giac | Mupad |
|---|---|---|---|---|---|---|---|---|---|
| grade | N/A | A | A | A | B | A | A | A | B |
| verified | N/A | Yes | Yes | Yes | TBD | TBD | TBD | TBD | TBD |
| size | 186 | 186 | 101 | 127 | 406 | 126 | 228 | 128 | 172 |
| N.S. | 1 | 1.00 | 0.54 | 0.68 | 2.18 | 0.68 | 1.23 | 0.69 | 0.92 |
| time (sec) | N/A | 0.526 | 0.161 | 0.253 | 0.208 | 0.277 | 0.342 | 0.290 | 0.325 |

| Problem 11 | Optimal | Rubi | MMA | Maple | Maxima | Fricas | Sympy | Giac | Mupad |
|---|---|---|---|---|---|---|---|---|---|
| grade | N/A | A | A | A | A | A | A | A | B |
| verified | N/A | Yes | Yes | Yes | TBD | TBD | TBD | TBD | TBD |
| size | 135 | 135 | 87 | 94 | 259 | 95 | 172 | 95 | 128 |
| N.S. | 1 | 1.00 | 0.64 | 0.70 | 1.92 | 0.70 | 1.27 | 0.70 | 0.95 |
| time (sec) | N/A | 0.387 | 0.127 | 0.254 | 0.199 | 0.289 | 0.265 | 0.271 | 6.034 |

| Problem 12 | Optimal | Rubi | MMA | Maple | Maxima | Fricas | Sympy | Giac | Mupad |
|---|---|---|---|---|---|---|---|---|---|
| grade | N/A | A | A | A | B | A | B | A | B |
| verified | N/A | Yes | Yes | Yes | TBD | TBD | TBD | TBD | TBD |
| size | 50 | 52 | 57 | 61 | 141 | 63 | 112 | 65 | 84 |
| N.S. | 1 | 1.04 | 1.14 | 1.22 | 2.82 | 1.26 | 2.24 | 1.30 | 1.68 |
| time (sec) | N/A | 0.323 | 0.126 | 0.221 | 0.194 | 0.261 | 0.201 | 0.279 | 5.929 |

| Problem 13 | Optimal | Rubi | MMA | Maple | Maxima | Fricas | Sympy | Giac | Mupad |
|---|---|---|---|---|---|---|---|---|---|
| grade | N/A | A | A | A | C | A | A | C | F(-1) |
| verified | N/A | Yes | Yes | Yes | TBD | TBD | TBD | TBD | TBD |
| size | 62 | 62 | 51 | 79 | 80 | 61 | 92 | 551 | 0 |
| N.S. | 1 | 1.00 | 0.82 | 1.27 | 1.29 | 0.98 | 1.48 | 8.89 | 0.00 |
| time (sec) | N/A | 0.346 | 0.202 | 0.256 | 0.455 | 0.277 | 1.410 | 0.279 | 0.000 |

| Problem 14 | Optimal | Rubi | MMA | Maple | Maxima | Fricas | Sympy | Giac | Mupad |
|---|---|---|---|---|---|---|---|---|---|
| grade | N/A | A | A | A | C | A | F | C | F(-1) |
| verified | N/A | Yes | Yes | Yes | TBD | TBD | TBD | TBD | TBD |
| size | 72 | 72 | 64 | 74 | 122 | 84 | 0 | 743 | 0 |
| N.S. | 1 | 1.00 | 0.89 | 1.03 | 1.69 | 1.17 | 0.00 | 10.32 | 0.00 |
| time (sec) | N/A | 0.406 | 0.163 | 0.247 | 0.684 | 0.283 | 0.000 | 0.286 | 0.000 |

| Problem 15 | Optimal | Rubi | MMA | Maple | Maxima | Fricas | Sympy | Giac | Mupad |
|---|---|---|---|---|---|---|---|---|---|
| grade | N/A | A | A | A | C | A | F | C | F(-1) |
| verified | N/A | Yes | Yes | Yes | TBD | TBD | TBD | TBD | TBD |
| size | 121 | 121 | 95 | 114 | 189 | 110 | 0 | 1182 | 0 |
| N.S. | 1 | 1.00 | 0.79 | 0.94 | 1.56 | 0.91 | 0.00 | 9.77 | 0.00 |
| time (sec) | N/A | 0.507 | 0.273 | 0.265 | 1.106 | 0.263 | 0.000 | 0.300 | 0.000 |

| Problem 16 | Optimal | Rubi | MMA | Maple | Maxima | Fricas | Sympy | Giac | Mupad |
|---|---|---|---|---|---|---|---|---|---|
| grade | N/A | A | A | A | C | A | F | C | F(-1) |
| verified | N/A | Yes | Yes | Yes | TBD | TBD | TBD | TBD | TBD |
| size | 175 | 175 | 154 | 158 | 187 | 145 | 0 | 1400 | 0 |
| N.S. | 1 | 1.00 | 0.88 | 0.90 | 1.07 | 0.83 | 0.00 | 8.00 | 0.00 |
| time (sec) | N/A | 0.580 | 0.345 | 0.298 | 1.238 | 0.260 | 0.000 | 0.299 | 0.000 |

| Problem 17 | Optimal | Rubi | MMA | Maple | Maxima | Fricas | Sympy | Giac | Mupad |
|---|---|---|---|---|---|---|---|---|---|
| grade | N/A | A | A | A | C | A | F | C | F(-1) |
| verified | N/A | Yes | Yes | Yes | TBD | TBD | TBD | TBD | TBD |
| size | 248 | 248 | 204 | 201 | 186 | 180 | 0 | 1712 | 0 |
| N.S. | 1 | 1.00 | 0.82 | 0.81 | 0.75 | 0.73 | 0.00 | 6.90 | 0.00 |
| time (sec) | N/A | 0.656 | 0.274 | 0.336 | 1.356 | 0.269 | 0.000 | 0.318 | 0.000 |

| Problem 18 | Optimal | Rubi | MMA | Maple | Maxima | Fricas | Sympy | Giac | Mupad |
|---|---|---|---|---|---|---|---|---|---|
| grade | N/A | A | A | C | F | A | F | C | F(-1) |
| verified | N/A | Yes | Yes | No | TBD | TBD | TBD | TBD | TBD |
| size | 218 | 218 | 158 | 328 | 0 | 188 | 0 | 3337 | 0 |
| N.S. | 1 | 1.00 | 0.72 | 1.50 | 0.00 | 0.86 | 0.00 | 15.31 | 0.00 |
| time (sec) | N/A | 0.665 | 0.414 | 0.424 | 0.000 | 0.269 | 0.000 | 0.355 | 0.000 |

| Problem 19 | Optimal | Rubi | MMA | Maple | Maxima | Fricas | Sympy | Giac | Mupad |
|---|---|---|---|---|---|---|---|---|---|
| grade | N/A | A | A | C | F | A | F | C | F(-1) |
| verified | N/A | Yes | Yes | Yes | TBD | TBD | TBD | TBD | TBD |
| size | 152 | 152 | 117 | 237 | 0 | 141 | 0 | 2709 | 0 |
| N.S. | 1 | 1.00 | 0.77 | 1.56 | 0.00 | 0.93 | 0.00 | 17.82 | 0.00 |
| time (sec) | N/A | 0.504 | 0.354 | 0.316 | 0.000 | 0.287 | 0.000 | 0.343 | 0.000 |

| Problem 20 | Optimal | Rubi | MMA | Maple | Maxima | Fricas | Sympy | Giac | Mupad |
|---|---|---|---|---|---|---|---|---|---|
| grade | N/A | A | A | C | F | A | F | C | F(-1) |
| verified | N/A | Yes | Yes | Yes | TBD | TBD | TBD | TBD | TBD |
| size | 99 | 99 | 87 | 180 | 0 | 108 | 0 | 2205 | 0 |
| N.S. | 1 | 1.00 | 0.88 | 1.82 | 0.00 | 1.09 | 0.00 | 22.27 | 0.00 |
| time (sec) | N/A | 0.432 | 0.192 | 0.274 | 0.000 | 0.280 | 0.000 | 0.350 | 0.000 |

| Problem 21 | Optimal | Rubi | MMA | Maple | Maxima | Fricas | Sympy | Giac | Mupad |
|---|---|---|---|---|---|---|---|---|---|
| grade | N/A | A | A | C | C | A | F | C | F(-1) |
| verified | N/A | Yes | Yes | Yes | TBD | TBD | TBD | TBD | TBD |
| size | 69 | 69 | 63 | 150 | 776 | 78 | 0 | 1647 | 0 |
| N.S. | 1 | 1.00 | 0.91 | 2.17 | 11.25 | 1.13 | 0.00 | 23.87 | 0.00 |
| time (sec) | N/A | 0.359 | 0.106 | 0.254 | 0.283 | 0.270 | 0.000 | 0.316 | 0.000 |

| Problem 22 | Optimal | Rubi | MMA | Maple | Maxima | Fricas | Sympy | Giac | Mupad |
|---|---|---|---|---|---|---|---|---|---|
| grade | N/A | A | A | A | C | A | F | C | F(-1) |
| verified | N/A | Yes | Yes | Yes | TBD | TBD | TBD | TBD | TBD |
| size | 51 | 51 | 49 | 73 | 141 | 63 | 0 | 597 | 0 |
| N.S. | 1 | 1.00 | 0.96 | 1.43 | 2.76 | 1.24 | 0.00 | 11.71 | 0.00 |
| time (sec) | N/A | 0.358 | 0.069 | 0.219 | 0.224 | 0.274 | 0.000 | 0.326 | 0.000 |

| Problem 23 | Optimal | Rubi | MMA | Maple | Maxima | Fricas | Sympy | Giac | Mupad |
|---|---|---|---|---|---|---|---|---|---|
| grade | N/A | A | A | A | F | A | F | C | F(-1) |
| verified | N/A | Yes | Yes | Yes | TBD | TBD | TBD | TBD | TBD |
| size | 73 | 73 | 63 | 99 | 0 | 76 | 0 | 838 | 0 |
| N.S. | 1 | 1.00 | 0.86 | 1.36 | 0.00 | 1.04 | 0.00 | 11.48 | 0.00 |
| time (sec) | N/A | 0.422 | 0.105 | 0.236 | 0.000 | 0.324 | 0.000 | 0.309 | 0.000 |

| Problem 24 | Optimal | Rubi | MMA | Maple | Maxima | Fricas | Sympy | Giac | Mupad |
|---|---|---|---|---|---|---|---|---|---|
| grade | N/A | A | A | A | F | A | F | C | F(-1) |
| verified | N/A | Yes | Yes | Yes | TBD | TBD | TBD | TBD | TBD |
| size | 114 | 114 | 101 | 144 | 0 | 118 | 0 | 2897 | 0 |
| N.S. | 1 | 1.00 | 0.89 | 1.26 | 0.00 | 1.04 | 0.00 | 25.41 | 0.00 |
| time (sec) | N/A | 0.531 | 0.265 | 0.305 | 0.000 | 0.274 | 0.000 | 0.360 | 0.000 |

| Problem 25 | Optimal | Rubi | MMA | Maple | Maxima | Fricas | Sympy | Giac | Mupad |
|---|---|---|---|---|---|---|---|---|---|
| grade | N/A | A | A | A | F | A | F | C | F(-1) |
| verified | N/A | Yes | Yes | Yes | TBD | TBD | TBD | TBD | TBD |
| size | 189 | 189 | 176 | 202 | 0 | 186 | 0 | 4565 | 0 |
| N.S. | 1 | 1.00 | 0.93 | 1.07 | 0.00 | 0.98 | 0.00 | 24.15 | 0.00 |
| time (sec) | N/A | 0.671 | 0.427 | 0.361 | 0.000 | 0.280 | 0.000 | 0.355 | 0.000 |

| Problem 26 | Optimal | Rubi | MMA | Maple | Maxima | Fricas | Sympy | Giac | Mupad |
|---|---|---|---|---|---|---|---|---|---|
| grade | N/A | A | A | C | F | A | F | B | F(-1) |
| verified | N/A | Yes | Yes | Yes | TBD | TBD | TBD | TBD | TBD |
| size | 233 | 233 | 177 | 734 | 0 | 287 | 0 | 1973 | 0 |
| N.S. | 1 | 1.00 | 0.76 | 3.15 | 0.00 | 1.23 | 0.00 | 8.47 | 0.00 |
| time (sec) | N/A | 0.726 | 0.667 | 0.475 | 0.000 | 0.300 | 0.000 | 0.372 | 0.000 |

| Problem 27 | Optimal | Rubi | MMA | Maple | Maxima | Fricas | Sympy | Giac | Mupad |
|---|---|---|---|---|---|---|---|---|---|
| grade | N/A | A | A | C | F | A | F | B | F(-1) |
| verified | N/A | Yes | Yes | Yes | TBD | TBD | TBD | TBD | TBD |
| size | 181 | 181 | 153 | 607 | 0 | 246 | 0 | 1474 | 0 |
| N.S. | 1 | 1.00 | 0.85 | 3.35 | 0.00 | 1.36 | 0.00 | 8.14 | 0.00 |
| time (sec) | N/A | 0.616 | 0.578 | 0.408 | 0.000 | 0.289 | 0.000 | 0.376 | 0.000 |

| Problem 28 | Optimal | Rubi | MMA | Maple | Maxima | Fricas | Sympy | Giac | Mupad |
|---|---|---|---|---|---|---|---|---|---|
| grade | N/A | A | A | C | F | A | F | B | F(-1) |
| verified | N/A | Yes | Yes | Yes | TBD | TBD | TBD | TBD | TBD |
| size | 149 | 149 | 117 | 402 | 0 | 202 | 0 | 1120 | 0 |
| N.S. | 1 | 1.00 | 0.79 | 2.70 | 0.00 | 1.36 | 0.00 | 7.52 | 0.00 |
| time (sec) | N/A | 0.574 | 0.530 | 0.309 | 0.000 | 0.293 | 0.000 | 0.331 | 0.000 |

| Problem 29 | Optimal | Rubi | MMA | Maple | Maxima | Fricas | Sympy | Giac | Mupad |
|---|---|---|---|---|---|---|---|---|---|
| grade | N/A | A | A | C | F | A | F | B | F(-1) |
| verified | N/A | Yes | Yes | Yes | TBD | TBD | TBD | TBD | TBD |
| size | 124 | 124 | 96 | 313 | 0 | 155 | 0 | 951 | 0 |
| N.S. | 1 | 1.00 | 0.77 | 2.52 | 0.00 | 1.25 | 0.00 | 7.67 | 0.00 |
| time (sec) | N/A | 0.498 | 0.336 | 0.280 | 0.000 | 0.284 | 0.000 | 0.346 | 0.000 |

| Problem 30 | Optimal | Rubi | MMA | Maple | Maxima | Fricas | Sympy | Giac | Mupad |
|---|---|---|---|---|---|---|---|---|---|
| grade | N/A | A | A | A | C | A | F | B | F(-1) |
| verified | N/A | Yes | Yes | Yes | TBD | TBD | TBD | TBD | TBD |
| size | 72 | 76 | 66 | 107 | 164 | 96 | 0 | 518 | 0 |
| N.S. | 1 | 1.06 | 0.92 | 1.49 | 2.28 | 1.33 | 0.00 | 7.19 | 0.00 |
| time (sec) | N/A | 0.490 | 0.169 | 0.251 | 0.238 | 0.277 | 0.000 | 0.299 | 0.000 |

| Problem 31 | Optimal | Rubi | MMA | Maple | Maxima | Fricas | Sympy | Giac | Mupad |
|---|---|---|---|---|---|---|---|---|---|
| grade | N/A | A | A | A | F | A | F | B | F(-1) |
| verified | N/A | Yes | Yes | Yes | TBD | TBD | TBD | TBD | TBD |
| size | 149 | 149 | 138 | 210 | 0 | 189 | 0 | 1281 | 0 |
| N.S. | 1 | 1.00 | 0.93 | 1.41 | 0.00 | 1.27 | 0.00 | 8.60 | 0.00 |
| time (sec) | N/A | 0.572 | 0.702 | 0.283 | 0.000 | 0.293 | 0.000 | 0.335 | 0.000 |

| Problem 32 | Optimal | Rubi | MMA | Maple | Maxima | Fricas | Sympy | Giac | Mupad |
|---|---|---|---|---|---|---|---|---|---|
| grade | N/A | A | A | A | F | A | F | B | F(-1) |
| verified | N/A | Yes | Yes | Yes | TBD | TBD | TBD | TBD | TBD |
| size | 188 | 188 | 184 | 256 | 0 | 262 | 0 | 3180 | 0 |
| N.S. | 1 | 1.00 | 0.98 | 1.36 | 0.00 | 1.39 | 0.00 | 16.91 | 0.00 |
| time (sec) | N/A | 0.699 | 1.254 | 0.336 | 0.000 | 0.315 | 0.000 | 0.379 | 0.000 |

| Problem 33 | Optimal | Rubi | MMA | Maple | Maxima | Fricas | Sympy | Giac | Mupad |
|---|---|---|---|---|---|---|---|---|---|
| grade | N/A | A | A | C | F | A | F | C | F(-1) |
| verified | N/A | Yes | Yes | Yes | TBD | TBD | TBD | TBD | TBD |
| size | 265 | 265 | 235 | 705 | 0 | 388 | 0 | 16724 | 0 |
| N.S. | 1 | 1.00 | 0.89 | 2.66 | 0.00 | 1.46 | 0.00 | 63.11 | 0.00 |
| time (sec) | N/A | 0.810 | 0.642 | 0.484 | 0.000 | 0.326 | 0.000 | 0.640 | 0.000 |

| Problem 34 | Optimal | Rubi | MMA | Maple | Maxima | Fricas | Sympy | Giac | Mupad |
|---|---|---|---|---|---|---|---|---|---|
| grade | N/A | A | A | C | F | A | F | C | F(-1) |
| verified | N/A | Yes | Yes | Yes | TBD | TBD | TBD | TBD | TBD |
| size | 241 | 241 | 154 | 621 | 0 | 325 | 0 | 15410 | 0 |
| N.S. | 1 | 1.00 | 0.64 | 2.58 | 0.00 | 1.35 | 0.00 | 63.94 | 0.00 |
| time (sec) | N/A | 0.745 | 0.852 | 0.388 | 0.000 | 0.295 | 0.000 | 0.619 | 0.000 |

| Problem 35 | Optimal | Rubi | MMA | Maple | Maxima | Fricas | Sympy | Giac | Mupad |
|---|---|---|---|---|---|---|---|---|---|
| grade | N/A | A | A | B | F | A | F | C | F(-1) |
| verified | N/A | Yes | Yes | Yes | TBD | TBD | TBD | TBD | TBD |
| size | 179 | 179 | 157 | 419 | 0 | 263 | 0 | 10535 | 0 |
| N.S. | 1 | 1.00 | 0.88 | 2.34 | 0.00 | 1.47 | 0.00 | 58.85 | 0.00 |
| time (sec) | N/A | 0.560 | 0.388 | 0.353 | 0.000 | 0.307 | 0.000 | 0.541 | 0.000 |

| Problem 36 | Optimal | Rubi | MMA | Maple | Maxima | Fricas | Sympy | Giac | Mupad |
|---|---|---|---|---|---|---|---|---|---|
| grade | N/A | A | A | A | C | A | F | C | F(-1) |
| verified | N/A | Yes | Yes | Yes | TBD | TBD | TBD | TBD | TBD |
| size | 104 | 105 | 87 | 145 | 199 | 164 | 0 | 5727 | 0 |
| N.S. | 1 | 1.01 | 0.84 | 1.39 | 1.91 | 1.58 | 0.00 | 55.07 | 0.00 |
| time (sec) | N/A | 0.590 | 0.485 | 0.319 | 0.289 | 0.287 | 0.000 | 0.409 | 0.000 |

| Problem 37 | Optimal | Rubi | MMA | Maple | Maxima | Fricas | Sympy | Giac | Mupad |
|---|---|---|---|---|---|---|---|---|---|
| grade | N/A | A | A | A | F | A | F | C | F(-1) |
| verified | N/A | Yes | Yes | Yes | TBD | TBD | TBD | TBD | TBD |
| size | 261 | 261 | 449 | 359 | 0 | 391 | 0 | 17806 | 0 |
| N.S. | 1 | 1.00 | 1.72 | 1.38 | 0.00 | 1.50 | 0.00 | 68.22 | 0.00 |
| time (sec) | N/A | 0.767 | 0.648 | 0.369 | 0.000 | 0.319 | 0.000 | 0.671 | 0.000 |

| Problem 38 | Optimal | Rubi | MMA | Maple | Maxima | Fricas | Sympy | Giac | Mupad |
|---|---|---|---|---|---|---|---|---|---|
| grade | N/A | A | A | A | F | A | F | C | F(-1) |
| verified | N/A | Yes | Yes | Yes | TBD | TBD | TBD | TBD | TBD |
| size | 299 | 299 | 540 | 405 | 0 | 500 | 0 | 20808 | 0 |
| N.S. | 1 | 1.00 | 1.81 | 1.35 | 0.00 | 1.67 | 0.00 | 69.59 | 0.00 |
| time (sec) | N/A | 0.874 | 1.190 | 0.438 | 0.000 | 0.311 | 0.000 | 0.710 | 0.000 |

| Problem 39 | Optimal | Rubi | MMA | Maple | Maxima | Fricas | Sympy | Giac | Mupad |
|---|---|---|---|---|---|---|---|---|---|
| grade | N/A | A | A | A | F | A | F | C | F(-1) |
| verified | N/A | Yes | Yes | Yes | TBD | TBD | TBD | TBD | TBD |
| size | 377 | 377 | 630 | 466 | 0 | 585 | 0 | 24116 | 0 |
| N.S. | 1 | 1.00 | 1.67 | 1.24 | 0.00 | 1.55 | 0.00 | 63.97 | 0.00 |
| time (sec) | N/A | 1.020 | 1.238 | 0.544 | 0.000 | 0.332 | 0.000 | 0.756 | 0.000 |

| Problem 40 | Optimal | Rubi | MMA | Maple | Maxima | Fricas | Sympy | Giac | Mupad |
|---|---|---|---|---|---|---|---|---|---|
| grade | N/A | A | A | A | B | A | A | A | B |
| verified | N/A | Yes | Yes | Yes | TBD | TBD | TBD | TBD | TBD |
| size | 141 | 141 | 92 | 96 | 372 | 95 | 168 | 97 | 121 |
| N.S. | 1 | 1.00 | 0.65 | 0.68 | 2.64 | 0.67 | 1.19 | 0.69 | 0.86 |
| time (sec) | N/A | 0.396 | 0.132 | 0.170 | 0.198 | 0.299 | 0.417 | 0.295 | 0.436 |

| Problem 41 | Optimal | Rubi | MMA | Maple | Maxima | Fricas | Sympy | Giac | Mupad |
|---|---|---|---|---|---|---|---|---|---|
| grade | N/A | A | A | A | B | A | A | A | B |
| verified | N/A | Yes | Yes | Yes | TBD | TBD | TBD | TBD | TBD |
| size | 111 | 111 | 75 | 78 | 258 | 77 | 134 | 79 | 97 |
| N.S. | 1 | 1.00 | 0.68 | 0.70 | 2.32 | 0.69 | 1.21 | 0.71 | 0.87 |
| time (sec) | N/A | 0.331 | 0.080 | 0.146 | 0.191 | 0.272 | 0.324 | 0.280 | 6.074 |

| Problem 42 | Optimal | Rubi | MMA | Maple | Maxima | Fricas | Sympy | Giac | Mupad |
|---|---|---|---|---|---|---|---|---|---|
| grade | N/A | A | A | A | B | A | A | A | B |
| verified | N/A | Yes | Yes | Yes | TBD | TBD | TBD | TBD | TBD |
| size | 80 | 80 | 57 | 59 | 165 | 60 | 99 | 60 | 73 |
| N.S. | 1 | 1.00 | 0.71 | 0.74 | 2.06 | 0.75 | 1.24 | 0.75 | 0.91 |
| time (sec) | N/A | 0.266 | 0.065 | 0.164 | 0.187 | 0.284 | 0.255 | 0.299 | 0.166 |

| Problem 43 | Optimal | Rubi | MMA | Maple | Maxima | Fricas | Sympy | Giac | Mupad |
|---|---|---|---|---|---|---|---|---|---|
| grade | N/A | A | A | A | A | A | A | A | B |
| verified | N/A | Yes | Yes | Yes | TBD | TBD | TBD | TBD | TBD |
| size | 53 | 53 | 41 | 43 | 91 | 41 | 65 | 42 | 49 |
| N.S. | 1 | 1.00 | 0.77 | 0.81 | 1.72 | 0.77 | 1.23 | 0.79 | 0.92 |
| time (sec) | N/A | 0.216 | 0.043 | 0.134 | 0.182 | 0.266 | 0.188 | 0.294 | 5.946 |

| Problem 44 | Optimal | Rubi | MMA | Maple | Maxima | Fricas | Sympy | Giac | Mupad |
|---|---|---|---|---|---|---|---|---|---|
| grade | N/A | A | A | A | C | A | A | C | F(-1) |
| verified | N/A | Yes | Yes | Yes | TBD | TBD | TBD | TBD | TBD |
| size | 41 | 41 | 54 | 60 | 66 | 46 | 65 | 432 | 0 |
| N.S. | 1 | 1.00 | 1.32 | 1.46 | 1.61 | 1.12 | 1.59 | 10.54 | 0.00 |
| time (sec) | N/A | 0.241 | 0.079 | 0.151 | 0.397 | 0.271 | 1.872 | 0.324 | 0.000 |

| Problem 45 | Optimal | Rubi | MMA | Maple | Maxima | Fricas | Sympy | Giac | Mupad |
|---|---|---|---|---|---|---|---|---|---|
| grade | N/A | A | A | A | C | A | F | C | F(-1) |
| verified | N/A | Yes | Yes | Yes | TBD | TBD | TBD | TBD | TBD |
| size | 44 | 44 | 44 | 48 | 937 | 53 | 0 | 411 | 0 |
| N.S. | 1 | 1.00 | 1.00 | 1.09 | 21.30 | 1.20 | 0.00 | 9.34 | 0.00 |
| time (sec) | N/A | 0.246 | 0.057 | 0.157 | 0.375 | 0.276 | 0.000 | 0.290 | 0.000 |

| Problem 46 | Optimal | Rubi | MMA | Maple | Maxima | Fricas | Sympy | Giac | Mupad |
|---|---|---|---|---|---|---|---|---|---|
| grade | N/A | A | A | A | C | A | F | C | F(-1) |
| verified | N/A | Yes | Yes | Yes | TBD | TBD | TBD | TBD | TBD |
| size | 74 | 74 | 82 | 73 | 123 | 62 | 0 | 766 | 0 |
| N.S. | 1 | 1.00 | 1.11 | 0.99 | 1.66 | 0.84 | 0.00 | 10.35 | 0.00 |
| time (sec) | N/A | 0.306 | 0.109 | 0.166 | 0.651 | 0.279 | 0.000 | 0.294 | 0.000 |

| Problem 47 | Optimal | Rubi | MMA | Maple | Maxima | Fricas | Sympy | Giac | Mupad |
|---|---|---|---|---|---|---|---|---|---|
| grade | N/A | A | A | A | C | A | F | C | F(-1) |
| verified | N/A | Yes | Yes | Yes | TBD | TBD | TBD | TBD | TBD |
| size | 106 | 106 | 95 | 102 | 121 | 82 | 0 | 834 | 0 |
| N.S. | 1 | 1.00 | 0.90 | 0.96 | 1.14 | 0.77 | 0.00 | 7.87 | 0.00 |
| time (sec) | N/A | 0.359 | 0.097 | 0.197 | 0.723 | 0.272 | 0.000 | 0.308 | 0.000 |

| Problem 48 | Optimal | Rubi | MMA | Maple | Maxima | Fricas | Sympy | Giac | Mupad |
|---|---|---|---|---|---|---|---|---|---|
| grade | N/A | A | A | A | C | A | F | C | F(-1) |
| verified | N/A | Yes | Yes | Yes | TBD | TBD | TBD | TBD | TBD |
| size | 149 | 149 | 125 | 131 | 121 | 101 | 0 | 1086 | 0 |
| N.S. | 1 | 1.00 | 0.84 | 0.88 | 0.81 | 0.68 | 0.00 | 7.29 | 0.00 |
| time (sec) | N/A | 0.409 | 0.120 | 0.226 | 0.804 | 0.324 | 0.000 | 0.300 | 0.000 |

| Problem 49 | Optimal | Rubi | MMA | Maple | Maxima | Fricas | Sympy | Giac | Mupad |
|---|---|---|---|---|---|---|---|---|---|
| grade | N/A | A | A | A | B | A | A | A | B |
| verified | N/A | Yes | Yes | Yes | TBD | TBD | TBD | TBD | TBD |
| size | 236 | 236 | 139 | 160 | 612 | 154 | 286 | 162 | 186 |
| N.S. | 1 | 1.00 | 0.59 | 0.68 | 2.59 | 0.65 | 1.21 | 0.69 | 0.79 |
| time (sec) | N/A | 0.536 | 0.262 | 0.293 | 0.217 | 0.288 | 0.557 | 0.286 | 0.669 |

| Problem 50 | Optimal | Rubi | MMA | Maple | Maxima | Fricas | Sympy | Giac | Mupad |
|---|---|---|---|---|---|---|---|---|---|
| grade | N/A | A | A | A | B | A | A | A | B |
| verified | N/A | Yes | Yes | Yes | TBD | TBD | TBD | TBD | TBD |
| size | 185 | 185 | 113 | 127 | 438 | 126 | 226 | 129 | 151 |
| N.S. | 1 | 1.00 | 0.61 | 0.69 | 2.37 | 0.68 | 1.22 | 0.70 | 0.82 |
| time (sec) | N/A | 0.428 | 0.156 | 0.273 | 0.206 | 0.280 | 0.433 | 0.278 | 6.328 |

| Problem 51 | Optimal | Rubi | MMA | Maple | Maxima | Fricas | Sympy | Giac | Mupad |
|---|---|---|---|---|---|---|---|---|---|
| grade | N/A | A | A | A | B | A | A | A | B |
| verified | N/A | Yes | Yes | Yes | TBD | TBD | TBD | TBD | TBD |
| size | 138 | 138 | 86 | 94 | 292 | 97 | 172 | 99 | 118 |
| N.S. | 1 | 1.00 | 0.62 | 0.68 | 2.12 | 0.70 | 1.25 | 0.72 | 0.86 |
| time (sec) | N/A | 0.332 | 0.116 | 0.247 | 0.188 | 0.275 | 0.326 | 0.295 | 6.263 |

| Problem 52 | Optimal | Rubi | MMA | Maple | Maxima | Fricas | Sympy | Giac | Mupad |
|---|---|---|---|---|---|---|---|---|---|
| grade | N/A | A | A | C | C | A | A | C | F(-1) |
| verified | N/A | Yes | Yes | Yes | TBD | TBD | TBD | TBD | TBD |
| size | 111 | 111 | 82 | 128 | 116 | 97 | 160 | 725 | 0 |
| N.S. | 1 | 1.00 | 0.74 | 1.15 | 1.05 | 0.87 | 1.44 | 6.53 | 0.00 |
| time (sec) | N/A | 0.338 | 0.274 | 0.322 | 1.380 | 0.280 | 2.486 | 0.310 | 0.000 |

| Problem 53 | Optimal | Rubi | MMA | Maple | Maxima | Fricas | Sympy | Giac | Mupad |
|---|---|---|---|---|---|---|---|---|---|
| grade | N/A | A | A | A | C | A | F | C | F(-1) |
| verified | N/A | Yes | Yes | Yes | TBD | TBD | TBD | TBD | TBD |
| size | 97 | 97 | 97 | 156 | 97 | 96 | 0 | 1638 | 0 |
| N.S. | 1 | 1.00 | 1.00 | 1.61 | 1.00 | 0.99 | 0.00 | 16.89 | 0.00 |
| time (sec) | N/A | 0.322 | 0.178 | 0.347 | 1.118 | 0.303 | 0.000 | 0.322 | 0.000 |

| Problem 54 | Optimal | Rubi | MMA | Maple | Maxima | Fricas | Sympy | Giac | Mupad |
|---|---|---|---|---|---|---|---|---|---|
| grade | N/A | A | A | A | C | A | F | C | F(-1) |
| verified | N/A | Yes | Yes | Yes | TBD | TBD | TBD | TBD | TBD |
| size | 114 | 114 | 99 | 124 | 150 | 107 | 0 | 1058 | 0 |
| N.S. | 1 | 1.00 | 0.87 | 1.09 | 1.32 | 0.94 | 0.00 | 9.28 | 0.00 |
| time (sec) | N/A | 0.359 | 0.294 | 0.370 | 2.085 | 0.285 | 0.000 | 0.301 | 0.000 |

| Problem 55 | Optimal | Rubi | MMA | Maple | Maxima | Fricas | Sympy | Giac | Mupad |
|---|---|---|---|---|---|---|---|---|---|
| grade | N/A | A | A | A | C | A | F | C | F(-1) |
| verified | N/A | Yes | Yes | Yes | TBD | TBD | TBD | TBD | TBD |
| size | 134 | 134 | 114 | 120 | 140 | 116 | 0 | 1032 | 0 |
| N.S. | 1 | 1.00 | 0.85 | 0.90 | 1.04 | 0.87 | 0.00 | 7.70 | 0.00 |
| time (sec) | N/A | 0.418 | 0.276 | 0.357 | 1.489 | 0.287 | 0.000 | 0.302 | 0.000 |

| Problem 56 | Optimal | Rubi | MMA | Maple | Maxima | Fricas | Sympy | Giac | Mupad |
|---|---|---|---|---|---|---|---|---|---|
| grade | N/A | A | A | A | C | A | F | C | F(-1) |
| verified | N/A | Yes | Yes | Yes | TBD | TBD | TBD | TBD | TBD |
| size | 177 | 177 | 122 | 157 | 222 | 129 | 0 | 1497 | 0 |
| N.S. | 1 | 1.00 | 0.69 | 0.89 | 1.25 | 0.73 | 0.00 | 8.46 | 0.00 |
| time (sec) | N/A | 0.520 | 0.341 | 0.416 | 8.166 | 0.293 | 0.000 | 0.299 | 0.000 |

| Problem 57 | Optimal | Rubi | MMA | Maple | Maxima | Fricas | Sympy | Giac | Mupad |
|---|---|---|---|---|---|---|---|---|---|
| grade | N/A | A | C | C | F | C | F | F | F(-1) |
| verified | N/A | Yes | Yes | Yes | TBD | TBD | TBD | TBD | TBD |
| size | 273 | 273 | 269 | 323 | 0 | 240 | 0 | 0 | 0 |
| N.S. | 1 | 1.00 | 0.99 | 1.18 | 0.00 | 0.88 | 0.00 | 0.00 | 0.00 |
| time (sec) | N/A | 0.826 | 1.461 | 0.515 | 0.000 | 0.312 | 0.000 | 0.000 | 0.000 |

| Problem 58 | Optimal | Rubi | MMA | Maple | Maxima | Fricas | Sympy | Giac | Mupad |
|---|---|---|---|---|---|---|---|---|---|
| grade | N/A | A | C | C | F | C | F | F | F(-1) |
| verified | N/A | Yes | Yes | Yes | TBD | TBD | TBD | TBD | TBD |
| size | 209 | 209 | 214 | 266 | 0 | 185 | 0 | 0 | 0 |
| N.S. | 1 | 1.00 | 1.02 | 1.27 | 0.00 | 0.89 | 0.00 | 0.00 | 0.00 |
| time (sec) | N/A | 0.542 | 1.108 | 0.378 | 0.000 | 0.317 | 0.000 | 0.000 | 0.000 |

| Problem 59 | Optimal | Rubi | MMA | Maple | Maxima | Fricas | Sympy | Giac | Mupad |
|---|---|---|---|---|---|---|---|---|---|
| grade | N/A | A | C | C | F | C | F | F | F(-1) |
| verified | N/A | Yes | Yes | Yes | TBD | TBD | TBD | TBD | TBD |
| size | 227 | 227 | 216 | 264 | 0 | 195 | 0 | 0 | 0 |
| N.S. | 1 | 1.00 | 0.95 | 1.16 | 0.00 | 0.86 | 0.00 | 0.00 | 0.00 |
| time (sec) | N/A | 0.512 | 0.653 | 0.309 | 0.000 | 0.314 | 0.000 | 0.000 | 0.000 |

| Problem 60 | Optimal | Rubi | MMA | Maple | Maxima | Fricas | Sympy | Giac | Mupad |
|---|---|---|---|---|---|---|---|---|---|
| grade | N/A | A | C | C | F | C | F | F | F(-1) |
| verified | N/A | Yes | Yes | Yes | TBD | TBD | TBD | TBD | TBD |
| size | 177 | 177 | 155 | 234 | 0 | 146 | 0 | 0 | 0 |
| N.S. | 1 | 1.00 | 0.88 | 1.32 | 0.00 | 0.82 | 0.00 | 0.00 | 0.00 |
| time (sec) | N/A | 0.420 | 0.277 | 0.260 | 0.000 | 0.286 | 0.000 | 0.000 | 0.000 |

| Problem 61 | Optimal | Rubi | MMA | Maple | Maxima | Fricas | Sympy | Giac | Mupad |
|---|---|---|---|---|---|---|---|---|---|
| grade | N/A | A | C | A | F | C | F | F | F(-1) |
| verified | N/A | Yes | Yes | Yes | TBD | TBD | TBD | TBD | TBD |
| size | 213 | 213 | 163 | 225 | 0 | 187 | 0 | 0 | 0 |
| N.S. | 1 | 1.00 | 0.77 | 1.06 | 0.00 | 0.88 | 0.00 | 0.00 | 0.00 |
| time (sec) | N/A | 0.440 | 0.401 | 0.256 | 0.000 | 0.297 | 0.000 | 0.000 | 0.000 |

| Problem 62 | Optimal | Rubi | MMA | Maple | Maxima | Fricas | Sympy | Giac | Mupad |
|---|---|---|---|---|---|---|---|---|---|
| grade | N/A | A | C | A | F | C | F | F | F(-1) |
| verified | N/A | Yes | Yes | Yes | TBD | TBD | TBD | TBD | TBD |
| size | 197 | 197 | 174 | 200 | 0 | 162 | 0 | 0 | 0 |
| N.S. | 1 | 1.00 | 0.88 | 1.02 | 0.00 | 0.82 | 0.00 | 0.00 | 0.00 |
| time (sec) | N/A | 0.547 | 0.358 | 0.266 | 0.000 | 0.302 | 0.000 | 0.000 | 0.000 |

| Problem 63 | Optimal | Rubi | MMA | Maple | Maxima | Fricas | Sympy | Giac | Mupad |
|---|---|---|---|---|---|---|---|---|---|
| grade | N/A | A | C | A | F | C | F | F | F(-1) |
| verified | N/A | Yes | Yes | Yes | TBD | TBD | TBD | TBD | TBD |
| size | 250 | 250 | 238 | 266 | 0 | 234 | 0 | 0 | 0 |
| N.S. | 1 | 1.00 | 0.95 | 1.06 | 0.00 | 0.94 | 0.00 | 0.00 | 0.00 |
| time (sec) | N/A | 0.623 | 0.573 | 0.332 | 0.000 | 0.339 | 0.000 | 0.000 | 0.000 |

| Problem 64 | Optimal | Rubi | MMA | Maple | Maxima | Fricas | Sympy | Giac | Mupad |
|---|---|---|---|---|---|---|---|---|---|
| grade | N/A | A | C | A | F | C | F | F | F(-1) |
| verified | N/A | Yes | Yes | Yes | TBD | TBD | TBD | TBD | TBD |
| size | 270 | 270 | 240 | 259 | 0 | 225 | 0 | 0 | 0 |
| N.S. | 1 | 1.00 | 0.89 | 0.96 | 0.00 | 0.83 | 0.00 | 0.00 | 0.00 |
| time (sec) | N/A | 0.660 | 0.833 | 0.377 | 0.000 | 0.302 | 0.000 | 0.000 | 0.000 |

| Problem 65 | Optimal | Rubi | MMA | Maple | Maxima | Fricas | Sympy | Giac | Mupad |
|---|---|---|---|---|---|---|---|---|---|
| grade | N/A | A | C | C | F | C | F | F | F(-1) |
| verified | N/A | Yes | Yes | Yes | TBD | TBD | TBD | TBD | TBD |
| size | 450 | 476 | 298 | 524 | 0 | 351 | 0 | 0 | 0 |
| N.S. | 1 | 1.06 | 0.66 | 1.16 | 0.00 | 0.78 | 0.00 | 0.00 | 0.00 |
| time (sec) | N/A | 1.165 | 3.153 | 0.779 | 0.000 | 0.321 | 0.000 | 0.000 | 0.000 |

| Problem 66 | Optimal | Rubi | MMA | Maple | Maxima | Fricas | Sympy | Giac | Mupad |
|---|---|---|---|---|---|---|---|---|---|
| grade | N/A | A | C | C | F | C | F | F | F(-1) |
| verified | N/A | Yes | Yes | Yes | TBD | TBD | TBD | TBD | TBD |
| size | 431 | 441 | 286 | 852 | 0 | 291 | 0 | 0 | 0 |
| N.S. | 1 | 1.02 | 0.66 | 1.98 | 0.00 | 0.68 | 0.00 | 0.00 | 0.00 |
| time (sec) | N/A | 0.999 | 1.825 | 0.627 | 0.000 | 0.316 | 0.000 | 0.000 | 0.000 |

| Problem 67 | Optimal | Rubi | MMA | Maple | Maxima | Fricas | Sympy | Giac | Mupad |
|---|---|---|---|---|---|---|---|---|---|
| grade | N/A | A | C | C | F | C | F | F | F(-1) |
| verified | N/A | Yes | Yes | Yes | TBD | TBD | TBD | TBD | TBD |
| size | 416 | 429 | 274 | 748 | 0 | 333 | 0 | 0 | 0 |
| N.S. | 1 | 1.03 | 0.66 | 1.80 | 0.00 | 0.80 | 0.00 | 0.00 | 0.00 |
| time (sec) | N/A | 0.960 | 2.013 | 0.517 | 0.000 | 0.298 | 0.000 | 0.000 | 0.000 |

| Problem 68 | Optimal | Rubi | MMA | Maple | Maxima | Fricas | Sympy | Giac | Mupad |
|---|---|---|---|---|---|---|---|---|---|
| grade | N/A | A | C | C | F | C | F | F | F(-1) |
| verified | N/A | Yes | Yes | Yes | TBD | TBD | TBD | TBD | TBD |
| size | 239 | 244 | 236 | 412 | 0 | 244 | 0 | 0 | 0 |
| N.S. | 1 | 1.02 | 0.99 | 1.72 | 0.00 | 1.02 | 0.00 | 0.00 | 0.00 |
| time (sec) | N/A | 0.501 | 0.972 | 0.427 | 0.000 | 0.297 | 0.000 | 0.000 | 0.000 |

| Problem 69 | Optimal | Rubi | MMA | Maple | Maxima | Fricas | Sympy | Giac | Mupad |
|---|---|---|---|---|---|---|---|---|---|
| grade | N/A | A | C | A | F | C | F | F | F(-1) |
| verified | N/A | Yes | Yes | Yes | TBD | TBD | TBD | TBD | TBD |
| size | 476 | 476 | 280 | 491 | 0 | 333 | 0 | 0 | 0 |
| N.S. | 1 | 1.00 | 0.59 | 1.03 | 0.00 | 0.70 | 0.00 | 0.00 | 0.00 |
| time (sec) | N/A | 1.010 | 1.952 | 0.349 | 0.000 | 0.323 | 0.000 | 0.000 | 0.000 |

| Problem 70 | Optimal | Rubi | MMA | Maple | Maxima | Fricas | Sympy | Giac | Mupad |
|---|---|---|---|---|---|---|---|---|---|
| grade | N/A | A | C | A | F | C | F | F | F(-1) |
| verified | N/A | Yes | Yes | Yes | TBD | TBD | TBD | TBD | TBD |
| size | 435 | 435 | 419 | 478 | 0 | 320 | 0 | 0 | 0 |
| N.S. | 1 | 1.00 | 0.96 | 1.10 | 0.00 | 0.74 | 0.00 | 0.00 | 0.00 |
| time (sec) | N/A | 0.993 | 0.949 | 0.396 | 0.000 | 0.306 | 0.000 | 0.000 | 0.000 |

| Problem 71 | Optimal | Rubi | MMA | Maple | Maxima | Fricas | Sympy | Giac | Mupad |
|---|---|---|---|---|---|---|---|---|---|
| grade | N/A | A | C | C | F | C | F | F | F(-1) |
| verified | N/A | Yes | Yes | Yes | TBD | TBD | TBD | TBD | TBD |
| size | 501 | 501 | 330 | 622 | 0 | 400 | 0 | 0 | 0 |
| N.S. | 1 | 1.00 | 0.66 | 1.24 | 0.00 | 0.80 | 0.00 | 0.00 | 0.00 |
| time (sec) | N/A | 1.364 | 2.305 | 0.477 | 0.000 | 0.338 | 0.000 | 0.000 | 0.000 |

| Problem 72 | Optimal | Rubi | MMA | Maple | Maxima | Fricas | Sympy | Giac | Mupad |
|---|---|---|---|---|---|---|---|---|---|
| grade | N/A | A | C | C | F | C | F(-1) | F | F(-1) |
| verified | N/A | Yes | Yes | Yes | TBD | TBD | TBD | TBD | TBD |
| size | 476 | 714 | 330 | 640 | 0 | 492 | 0 | 0 | 0 |
| N.S. | 1 | 1.50 | 0.69 | 1.34 | 0.00 | 1.03 | 0.00 | 0.00 | 0.00 |
| time (sec) | N/A | 1.806 | 2.476 | 1.102 | 0.000 | 0.296 | 0.000 | 0.000 | 0.000 |

| Problem 73 | Optimal | Rubi | MMA | Maple | Maxima | Fricas | Sympy | Giac | Mupad |
|---|---|---|---|---|---|---|---|---|---|
| grade | N/A | A | C | C | F | C | F(-1) | F | F(-1) |
| verified | N/A | Yes | Yes | Yes | TBD | TBD | TBD | TBD | TBD |
| size | 746 | 759 | 364 | 912 | 0 | 604 | 0 | 0 | 0 |
| N.S. | 1 | 1.02 | 0.49 | 1.22 | 0.00 | 0.81 | 0.00 | 0.00 | 0.00 |
| time (sec) | N/A | 1.795 | 3.364 | 0.862 | 0.000 | 0.316 | 0.000 | 0.000 | 0.000 |

| Problem 74 | Optimal | Rubi | MMA | Maple | Maxima | Fricas | Sympy | Giac | Mupad |
|---|---|---|---|---|---|---|---|---|---|
| grade | N/A | A | C | C | F | C | F(-1) | F | F(-1) |
| verified | N/A | Yes | Yes | Yes | TBD | TBD | TBD | TBD | TBD |
| size | 512 | 507 | 317 | 628 | 0 | 483 | 0 | 0 | 0 |
| N.S. | 1 | 0.99 | 0.62 | 1.23 | 0.00 | 0.94 | 0.00 | 0.00 | 0.00 |
| time (sec) | N/A | 0.995 | 2.529 | 0.685 | 0.000 | 0.317 | 0.000 | 0.000 | 0.000 |

| Problem 75 | Optimal | Rubi | MMA | Maple | Maxima | Fricas | Sympy | Giac | Mupad |
|---|---|---|---|---|---|---|---|---|---|
| grade | N/A | A | C | A | F | C | F(-1) | F | F(-1) |
| verified | N/A | Yes | Yes | Yes | TBD | TBD | TBD | TBD | TBD |
| size | 856 | 856 | 374 | 598 | 0 | 611 | 0 | 0 | 0 |
| N.S. | 1 | 1.00 | 0.44 | 0.70 | 0.00 | 0.71 | 0.00 | 0.00 | 0.00 |
| time (sec) | N/A | 1.589 | 2.987 | 0.525 | 0.000 | 0.297 | 0.000 | 0.000 | 0.000 |

| Problem 76 | Optimal | Rubi | MMA | Maple | Maxima | Fricas | Sympy | Giac | Mupad |
|---|---|---|---|---|---|---|---|---|---|
| grade | N/A | A | C | A | F | C | F | F | F(-1) |
| verified | N/A | Yes | Yes | Yes | TBD | TBD | TBD | TBD | TBD |
| size | 730 | 730 | 672 | 580 | 0 | 637 | 0 | 0 | 0 |
| N.S. | 1 | 1.00 | 0.92 | 0.79 | 0.00 | 0.87 | 0.00 | 0.00 | 0.00 |
| time (sec) | N/A | 1.923 | 2.363 | 0.562 | 0.000 | 0.365 | 0.000 | 0.000 | 0.000 |

| Problem 77 | Optimal | Rubi | MMA | Maple | Maxima | Fricas | Sympy | Giac | Mupad |
|---|---|---|---|---|---|---|---|---|---|
| grade | N/A | A | C | C | F | C | F(-1) | F | F(-1) |
| verified | N/A | Yes | Yes | Yes | TBD | TBD | TBD | TBD | TBD |
| size | 875 | 875 | 593 | 910 | 0 | 714 | 0 | 0 | 0 |
| N.S. | 1 | 1.00 | 0.68 | 1.04 | 0.00 | 0.82 | 0.00 | 0.00 | 0.00 |
| time (sec) | N/A | 2.747 | 4.043 | 0.801 | 0.000 | 0.297 | 0.000 | 0.000 | 0.000 |

| Problem 78 | Optimal | Rubi | MMA | Maple | Maxima | Fricas | Sympy | Giac | Mupad |
|---|---|---|---|---|---|---|---|---|---|
| grade | N/A | A | C | A | F | C | F(-1) | F | F(-1) |
| verified | N/A | Yes | Yes | Yes | TBD | TBD | TBD | TBD | TBD |
| size | 791 | 791 | 432 | 697 | 0 | 758 | 0 | 0 | 0 |
| N.S. | 1 | 1.00 | 0.55 | 0.88 | 0.00 | 0.96 | 0.00 | 0.00 | 0.00 |
| time (sec) | N/A | 2.046 | 1.857 | 1.754 | 0.000 | 0.307 | 0.000 | 0.000 | 0.000 |

| Problem 79 | Optimal | Rubi | MMA | Maple | Maxima | Fricas | Sympy | Giac | Mupad |
|---|---|---|---|---|---|---|---|---|---|
| grade | N/A | A | A | A | B | A | A | A | B |
| verified | N/A | Yes | Yes | Yes | TBD | TBD | TBD | TBD | TBD |
| size | 156 | 156 | 101 | 106 | 449 | 104 | 185 | 106 | 151 |
| N.S. | 1 | 1.00 | 0.65 | 0.68 | 2.88 | 0.67 | 1.19 | 0.68 | 0.97 |
| time (sec) | N/A | 0.444 | 0.145 | 0.174 | 0.216 | 0.284 | 0.546 | 0.325 | 0.724 |

| Problem 80 | Optimal | Rubi | MMA | Maple | Maxima | Fricas | Sympy | Giac | Mupad |
|---|---|---|---|---|---|---|---|---|---|
| grade | N/A | A | A | A | B | A | A | A | B |
| verified | N/A | Yes | Yes | Yes | TBD | TBD | TBD | TBD | TBD |
| size | 126 | 126 | 84 | 88 | 326 | 87 | 151 | 88 | 121 |
| N.S. | 1 | 1.00 | 0.67 | 0.70 | 2.59 | 0.69 | 1.20 | 0.70 | 0.96 |
| time (sec) | N/A | 0.369 | 0.089 | 0.153 | 0.207 | 0.257 | 0.434 | 0.286 | 6.370 |

| Problem 81 | Optimal | Rubi | MMA | Maple | Maxima | Fricas | Sympy | Giac | Mupad |
|---|---|---|---|---|---|---|---|---|---|
| grade | N/A | A | A | A | B | A | A | A | B |
| verified | N/A | Yes | Yes | Yes | TBD | TBD | TBD | TBD | TBD |
| size | 95 | 95 | 66 | 69 | 224 | 68 | 116 | 69 | 92 |
| N.S. | 1 | 1.00 | 0.69 | 0.73 | 2.36 | 0.72 | 1.22 | 0.73 | 0.97 |
| time (sec) | N/A | 0.309 | 0.069 | 0.136 | 0.194 | 0.264 | 0.316 | 0.307 | 6.111 |

| Problem 82 | Optimal | Rubi | MMA | Maple | Maxima | Fricas | Sympy | Giac | Mupad |
|---|---|---|---|---|---|---|---|---|---|
| grade | N/A | A | A | A | B | A | A | A | B |
| verified | N/A | Yes | Yes | Yes | TBD | TBD | TBD | TBD | TBD |
| size | 68 | 68 | 50 | 52 | 141 | 52 | 82 | 54 | 65 |
| N.S. | 1 | 1.00 | 0.74 | 0.76 | 2.07 | 0.76 | 1.21 | 0.79 | 0.96 |
| time (sec) | N/A | 0.254 | 0.055 | 0.136 | 0.194 | 0.264 | 0.240 | 0.287 | 0.132 |

| Problem 83 | Optimal | Rubi | MMA | Maple | Maxima | Fricas | Sympy | Giac | Mupad |
|---|---|---|---|---|---|---|---|---|---|
| grade | N/A | A | A | C | C | A | A | C | F(-1) |
| verified | N/A | Yes | Yes | No | TBD | TBD | TBD | TBD | TBD |
| size | 57 | 57 | 50 | 98 | 76 | 58 | 83 | 510 | 0 |
| N.S. | 1 | 1.00 | 0.88 | 1.72 | 1.33 | 1.02 | 1.46 | 8.95 | 0.00 |
| time (sec) | N/A | 0.284 | 0.118 | 0.180 | 0.584 | 0.280 | 2.753 | 0.319 | 0.000 |

| Problem 84 | Optimal | Rubi | MMA | Maple | Maxima | Fricas | Sympy | Giac | Mupad |
|---|---|---|---|---|---|---|---|---|---|
| grade | N/A | A | A | A | C | A | F | C | F(-1) |
| verified | N/A | Yes | Yes | Yes | TBD | TBD | TBD | TBD | TBD |
| size | 56 | 56 | 56 | 79 | 69 | 64 | 0 | 489 | 0 |
| N.S. | 1 | 1.00 | 1.00 | 1.41 | 1.23 | 1.14 | 0.00 | 8.73 | 0.00 |
| time (sec) | N/A | 0.272 | 0.081 | 0.207 | 0.543 | 0.278 | 0.000 | 0.304 | 0.000 |

| Problem 85 | Optimal | Rubi | MMA | Maple | Maxima | Fricas | Sympy | Giac | Mupad |
|---|---|---|---|---|---|---|---|---|---|
| grade | N/A | A | A | A | C | A | F | C | F(-1) |
| verified | N/A | Yes | Yes | Yes | TBD | TBD | TBD | TBD | TBD |
| size | 70 | 70 | 66 | 65 | 1146 | 66 | 0 | 564 | 0 |
| N.S. | 1 | 1.00 | 0.94 | 0.93 | 16.37 | 0.94 | 0.00 | 8.06 | 0.00 |
| time (sec) | N/A | 0.280 | 0.089 | 0.201 | 0.449 | 0.268 | 0.000 | 0.322 | 0.000 |

| Problem 86 | Optimal | Rubi | MMA | Maple | Maxima | Fricas | Sympy | Giac | Mupad |
|---|---|---|---|---|---|---|---|---|---|
| grade | N/A | A | A | A | C | A | F | C | F(-1) |
| verified | N/A | Yes | Yes | Yes | TBD | TBD | TBD | TBD | TBD |
| size | 91 | 91 | 104 | 87 | 132 | 89 | 0 | 796 | 0 |
| N.S. | 1 | 1.00 | 1.14 | 0.96 | 1.45 | 0.98 | 0.00 | 8.75 | 0.00 |
| time (sec) | N/A | 0.351 | 0.118 | 0.220 | 0.904 | 0.278 | 0.000 | 0.301 | 0.000 |

| Problem 87 | Optimal | Rubi | MMA | Maple | Maxima | Fricas | Sympy | Giac | Mupad |
|---|---|---|---|---|---|---|---|---|---|
| grade | N/A | A | A | A | B | A | A | A | B |
| verified | N/A | Yes | Yes | Yes | TBD | TBD | TBD | TBD | TBD |
| size | 235 | 235 | 139 | 161 | 662 | 161 | 284 | 161 | 225 |
| N.S. | 1 | 1.00 | 0.59 | 0.69 | 2.82 | 0.69 | 1.21 | 0.69 | 0.96 |
| time (sec) | N/A | 0.547 | 0.238 | 0.318 | 0.245 | 0.303 | 0.798 | 0.309 | 6.446 |

| Problem 88 | Optimal | Rubi | MMA | Maple | Maxima | Fricas | Sympy | Giac | Mupad |
|---|---|---|---|---|---|---|---|---|---|
| grade | N/A | A | A | A | B | A | A | A | B |
| verified | N/A | Yes | Yes | Yes | TBD | TBD | TBD | TBD | TBD |
| size | 188 | 188 | 112 | 124 | 489 | 129 | 226 | 131 | 184 |
| N.S. | 1 | 1.00 | 0.60 | 0.66 | 2.60 | 0.69 | 1.20 | 0.70 | 0.98 |
| time (sec) | N/A | 0.461 | 0.199 | 0.277 | 0.226 | 0.286 | 0.569 | 0.316 | 0.771 |

| Problem 89 | Optimal | Rubi | MMA | Maple | Maxima | Fricas | Sympy | Giac | Mupad |
|---|---|---|---|---|---|---|---|---|---|
| grade | N/A | A | A | C | C | A | A | C | F(-1) |
| verified | N/A | Yes | Yes | Yes | TBD | TBD | TBD | TBD | TBD |
| size | 161 | 161 | 108 | 178 | 147 | 128 | 207 | 921 | 0 |
| N.S. | 1 | 1.00 | 0.67 | 1.11 | 0.91 | 0.80 | 1.29 | 5.72 | 0.00 |
| time (sec) | N/A | 0.433 | 0.350 | 0.426 | 5.679 | 0.270 | 3.693 | 0.340 | 0.000 |

| Problem 90 | Optimal | Rubi | MMA | Maple | Maxima | Fricas | Sympy | Giac | Mupad |
|---|---|---|---|---|---|---|---|---|---|
| grade | N/A | A | A | C | C | A | F | C | F(-1) |
| verified | N/A | Yes | Yes | No | TBD | TBD | TBD | TBD | TBD |
| size | 145 | 145 | 145 | 214 | 129 | 127 | 0 | 2038 | 0 |
| N.S. | 1 | 1.00 | 1.00 | 1.48 | 0.89 | 0.88 | 0.00 | 14.06 | 0.00 |
| time (sec) | N/A | 0.410 | 0.250 | 0.494 | 6.468 | 0.263 | 0.000 | 0.341 | 0.000 |

| Problem 91 | Optimal | Rubi | MMA | Maple | Maxima | Fricas | Sympy | Giac | Mupad |
|---|---|---|---|---|---|---|---|---|---|
| grade | N/A | A | A | C | C | A | F | C | F(-1) |
| verified | N/A | Yes | Yes | No | TBD | TBD | TBD | TBD | TBD |
| size | 142 | 142 | 138 | 210 | 110 | 123 | 0 | 2171 | 0 |
| N.S. | 1 | 1.00 | 0.97 | 1.48 | 0.77 | 0.87 | 0.00 | 15.29 | 0.00 |
| time (sec) | N/A | 0.397 | 0.245 | 0.496 | 2.189 | 0.277 | 0.000 | 0.317 | 0.000 |

| Problem 92 | Optimal | Rubi | MMA | Maple | Maxima | Fricas | Sympy | Giac | Mupad |
|---|---|---|---|---|---|---|---|---|---|
| grade | N/A | A | A | A | C | A | F | C | F(-1) |
| verified | N/A | Yes | Yes | Yes | TBD | TBD | TBD | TBD | TBD |
| size | 151 | 151 | 135 | 196 | 173 | 145 | 0 | 1181 | 0 |
| N.S. | 1 | 1.00 | 0.89 | 1.30 | 1.15 | 0.96 | 0.00 | 7.82 | 0.00 |
| time (sec) | N/A | 0.430 | 0.452 | 0.491 | 7.106 | 0.270 | 0.000 | 0.341 | 0.000 |

| Problem 93 | Optimal | Rubi | MMA | Maple | Maxima | Fricas | Sympy | Giac | Mupad |
|---|---|---|---|---|---|---|---|---|---|
| grade | N/A | A | A | A | C | A | F | C | F(-1) |
| verified | N/A | Yes | Yes | Yes | TBD | TBD | TBD | TBD | TBD |
| size | 167 | 167 | 148 | 167 | 164 | 153 | 0 | 1255 | 0 |
| N.S. | 1 | 1.00 | 0.89 | 1.00 | 0.98 | 0.92 | 0.00 | 7.51 | 0.00 |
| time (sec) | N/A | 0.469 | 0.372 | 0.559 | 5.946 | 0.304 | 0.000 | 0.307 | 0.000 |

| Problem 94 | Optimal | Rubi | MMA | Maple | Maxima | Fricas | Sympy | Giac | Mupad |
|---|---|---|---|---|---|---|---|---|---|
| grade | N/A | A | C | C | F | C | F | F | F(-1) |
| verified | N/A | Yes | Yes | Yes | TBD | TBD | TBD | TBD | TBD |
| size | 371 | 371 | 231 | 558 | 0 | 397 | 0 | 0 | 0 |
| N.S. | 1 | 1.00 | 0.62 | 1.50 | 0.00 | 1.07 | 0.00 | 0.00 | 0.00 |
| time (sec) | N/A | 1.008 | 0.139 | 0.400 | 0.000 | 0.321 | 0.000 | 0.000 | 0.000 |

| Problem 95 | Optimal | Rubi | MMA | Maple | Maxima | Fricas | Sympy | Giac | Mupad |
|---|---|---|---|---|---|---|---|---|---|
| grade | N/A | A | C | C | F | C | F | F | F(-1) |
| verified | N/A | Yes | Yes | Yes | TBD | TBD | TBD | TBD | TBD |
| size | 357 | 357 | 216 | 392 | 0 | 393 | 0 | 0 | 0 |
| N.S. | 1 | 1.00 | 0.61 | 1.10 | 0.00 | 1.10 | 0.00 | 0.00 | 0.00 |
| time (sec) | N/A | 0.816 | 0.109 | 0.370 | 0.000 | 0.298 | 0.000 | 0.000 | 0.000 |

| Problem 96 | Optimal | Rubi | MMA | Maple | Maxima | Fricas | Sympy | Giac | Mupad |
|---|---|---|---|---|---|---|---|---|---|
| grade | N/A | A | C | C | F | C | F | F | F(-1) |
| verified | N/A | Yes | Yes | Yes | TBD | TBD | TBD | TBD | TBD |
| size | 281 | 281 | 186 | 266 | 0 | 292 | 0 | 0 | 0 |
| N.S. | 1 | 1.00 | 0.66 | 0.95 | 0.00 | 1.04 | 0.00 | 0.00 | 0.00 |
| time (sec) | N/A | 0.671 | 5.041 | 0.286 | 0.000 | 0.276 | 0.000 | 0.000 | 0.000 |

| Problem 97 | Optimal | Rubi | MMA | Maple | Maxima | Fricas | Sympy | Giac | Mupad |
|---|---|---|---|---|---|---|---|---|---|
| grade | N/A | A | C | C | F | C | F | F | F(-1) |
| verified | N/A | Yes | Yes | Yes | TBD | TBD | TBD | TBD | TBD |
| size | 343 | 343 | 196 | 176 | 0 | 379 | 0 | 0 | 0 |
| N.S. | 1 | 1.00 | 0.57 | 0.51 | 0.00 | 1.10 | 0.00 | 0.00 | 0.00 |
| time (sec) | N/A | 0.649 | 5.052 | 0.279 | 0.000 | 0.302 | 0.000 | 0.000 | 0.000 |

| Problem 98 | Optimal | Rubi | MMA | Maple | Maxima | Fricas | Sympy | Giac | Mupad |
|---|---|---|---|---|---|---|---|---|---|
| grade | N/A | A | C | C | F | C | F | F | F(-1) |
| verified | N/A | Yes | Yes | Yes | TBD | TBD | TBD | TBD | TBD |
| size | 343 | 343 | 196 | 85 | 0 | 385 | 0 | 0 | 0 |
| N.S. | 1 | 1.00 | 0.57 | 0.25 | 0.00 | 1.12 | 0.00 | 0.00 | 0.00 |
| time (sec) | N/A | 0.625 | 5.049 | 0.267 | 0.000 | 0.301 | 0.000 | 0.000 | 0.000 |

| Problem 99 | Optimal | Rubi | MMA | Maple | Maxima | Fricas | Sympy | Giac | Mupad |
|---|---|---|---|---|---|---|---|---|---|
| grade | N/A | A | C | C | F | C | F | F | F(-1) |
| verified | N/A | Yes | Yes | Yes | TBD | TBD | TBD | TBD | TBD |
| size | 301 | 301 | 206 | 88 | 0 | 308 | 0 | 0 | 0 |
| N.S. | 1 | 1.00 | 0.68 | 0.29 | 0.00 | 1.02 | 0.00 | 0.00 | 0.00 |
| time (sec) | N/A | 0.726 | 0.133 | 0.291 | 0.000 | 0.345 | 0.000 | 0.000 | 0.000 |

| Problem 100 | Optimal | Rubi | MMA | Maple | Maxima | Fricas | Sympy | Giac | Mupad |
|---|---|---|---|---|---|---|---|---|---|
| grade | N/A | A | C | C | F | C | F | F | F(-1) |
| verified | N/A | Yes | Yes | Yes | TBD | TBD | TBD | TBD | TBD |
| size | 380 | 380 | 233 | 116 | 0 | 448 | 0 | 0 | 0 |
| N.S. | 1 | 1.00 | 0.61 | 0.31 | 0.00 | 1.18 | 0.00 | 0.00 | 0.00 |
| time (sec) | N/A | 0.786 | 0.175 | 0.408 | 0.000 | 0.315 | 0.000 | 0.000 | 0.000 |

| Problem 101 | Optimal | Rubi | MMA | Maple | Maxima | Fricas | Sympy | Giac | Mupad |
|---|---|---|---|---|---|---|---|---|---|
| grade | N/A | A | C | C | F | C | F | F | F(-1) |
| verified | N/A | Yes | Yes | Yes | TBD | TBD | TBD | TBD | TBD |
| size | 408 | 408 | 253 | 136 | 0 | 489 | 0 | 0 | 0 |
| N.S. | 1 | 1.00 | 0.62 | 0.33 | 0.00 | 1.20 | 0.00 | 0.00 | 0.00 |
| time (sec) | N/A | 0.859 | 0.232 | 0.453 | 0.000 | 0.299 | 0.000 | 0.000 | 0.000 |

| Problem 102 | Optimal | Rubi | MMA | Maple | Maxima | Fricas | Sympy | Giac | Mupad |
|---|---|---|---|---|---|---|---|---|---|
| grade | N/A | A | C | C | F | C | F(-1) | F | F(-1) |
| verified | N/A | Yes | Yes | Yes | TBD | TBD | TBD | TBD | TBD |
| size | 714 | 725 | 383 | 1184 | 0 | 670 | 0 | 0 | 0 |
| N.S. | 1 | 1.02 | 0.54 | 1.66 | 0.00 | 0.94 | 0.00 | 0.00 | 0.00 |
| time (sec) | N/A | 1.508 | 0.171 | 0.928 | 0.000 | 0.299 | 0.000 | 0.000 | 0.000 |

| Problem 103 | Optimal | Rubi | MMA | Maple | Maxima | Fricas | Sympy | Giac | Mupad |
|---|---|---|---|---|---|---|---|---|---|
| grade | N/A | A | C | C | F | C | F(-1) | F | F(-1) |
| verified | N/A | Yes | Yes | Yes | TBD | TBD | TBD | TBD | TBD |
| size | 371 | 374 | 214 | 823 | 0 | 482 | 0 | 0 | 0 |
| N.S. | 1 | 1.01 | 0.58 | 2.22 | 0.00 | 1.30 | 0.00 | 0.00 | 0.00 |
| time (sec) | N/A | 0.809 | 0.127 | 0.745 | 0.000 | 0.315 | 0.000 | 0.000 | 0.000 |

| Problem 104 | Optimal | Rubi | MMA | Maple | Maxima | Fricas | Sympy | Giac | Mupad |
|---|---|---|---|---|---|---|---|---|---|
| grade | N/A | A | C | C | F | C | F(-1) | F | F(-1) |
| verified | N/A | Yes | Yes | Yes | TBD | TBD | TBD | TBD | TBD |
| size | 691 | 723 | 408 | 508 | 0 | 655 | 0 | 0 | 0 |
| N.S. | 1 | 1.05 | 0.59 | 0.74 | 0.00 | 0.95 | 0.00 | 0.00 | 0.00 |
| time (sec) | N/A | 1.721 | 0.160 | 0.630 | 0.000 | 0.313 | 0.000 | 0.000 | 0.000 |

| Problem 105 | Optimal | Rubi | MMA | Maple | Maxima | Fricas | Sympy | Giac | Mupad |
|---|---|---|---|---|---|---|---|---|---|
| grade | N/A | A | C | C | F | C | F(-1) | F | F(-1) |
| verified | N/A | Yes | Yes | Yes | TBD | TBD | TBD | TBD | TBD |
| size | 735 | 830 | 406 | 248 | 0 | 669 | 0 | 0 | 0 |
| N.S. | 1 | 1.13 | 0.55 | 0.34 | 0.00 | 0.91 | 0.00 | 0.00 | 0.00 |
| time (sec) | N/A | 1.841 | 0.162 | 0.534 | 0.000 | 0.301 | 0.000 | 0.000 | 0.000 |

| Problem 106 | Optimal | Rubi | MMA | Maple | Maxima | Fricas | Sympy | Giac | Mupad |
|---|---|---|---|---|---|---|---|---|---|
| grade | N/A | A | C | C | F | C | F | F | F(-1) |
| verified | N/A | Yes | Yes | Yes | TBD | TBD | TBD | TBD | TBD |
| size | 693 | 842 | 446 | 233 | 0 | 576 | 0 | 0 | 0 |
| N.S. | 1 | 1.22 | 0.64 | 0.34 | 0.00 | 0.83 | 0.00 | 0.00 | 0.00 |
| time (sec) | N/A | 2.015 | 0.396 | 0.506 | 0.000 | 0.337 | 0.000 | 0.000 | 0.000 |

| Problem 107 | Optimal | Rubi | MMA | Maple | Maxima | Fricas | Sympy | Giac | Mupad |
|---|---|---|---|---|---|---|---|---|---|
| grade | N/A | A | C | C | F | C | F(-1) | F | F(-1) |
| verified | N/A | Yes | Yes | Yes | TBD | TBD | TBD | TBD | TBD |
| size | 712 | 920 | 445 | 284 | 0 | 720 | 0 | 0 | 0 |
| N.S. | 1 | 1.29 | 0.62 | 0.40 | 0.00 | 1.01 | 0.00 | 0.00 | 0.00 |
| time (sec) | N/A | 2.142 | 0.538 | 0.777 | 0.000 | 0.362 | 0.000 | 0.000 | 0.000 |

| Problem 108 | Optimal | Rubi | MMA | Maple | Maxima | Fricas | Sympy | Giac | Mupad |
|---|---|---|---|---|---|---|---|---|---|
| grade | N/A | A | C | C | F | C | F(-1) | F | F(-1) |
| verified | N/A | Yes | Yes | Yes | TBD | TBD | TBD | TBD | TBD |
| size | 800 | 1059 | 470 | 315 | 0 | 898 | 0 | 0 | 0 |
| N.S. | 1 | 1.32 | 0.59 | 0.39 | 0.00 | 1.12 | 0.00 | 0.00 | 0.00 |
| time (sec) | N/A | 2.258 | 0.624 | 0.928 | 0.000 | 0.353 | 0.000 | 0.000 | 0.000 |

| Problem 109 | Optimal | Rubi | MMA | Maple | Maxima | Fricas | Sympy | Giac | Mupad |
|---|---|---|---|---|---|---|---|---|---|
| grade | N/A | B | C | C | F | C | F(-1) | F | F(-1) |
| verified | N/A | Yes | Yes | Yes | TBD | TBD | TBD | TBD | TBD |
| size | 772 | 1592 | 457 | 1337 | 0 | 890 | 0 | 0 | 0 |
| N.S. | 1 | 2.06 | 0.59 | 1.73 | 0.00 | 1.15 | 0.00 | 0.00 | 0.00 |
| time (sec) | N/A | 3.479 | 0.461 | 2.246 | 0.000 | 0.325 | 0.000 | 0.000 | 0.000 |

| Problem 110 | Optimal | Rubi | MMA | Maple | Maxima | Fricas | Sympy | Giac | Mupad |
|---|---|---|---|---|---|---|---|---|---|
| grade | N/A | A | C | C | F | C | F(-1) | F | F(-1) |
| verified | N/A | Yes | Yes | Yes | TBD | TBD | TBD | TBD | TBD |
| size | 777 | 860 | 449 | 918 | 0 | 935 | 0 | 0 | 0 |
| N.S. | 1 | 1.11 | 0.58 | 1.18 | 0.00 | 1.20 | 0.00 | 0.00 | 0.00 |
| time (sec) | N/A | 1.946 | 0.313 | 1.738 | 0.000 | 0.343 | 0.000 | 0.000 | 0.000 |

| Problem 111 | Optimal | Rubi | MMA | Maple | Maxima | Fricas | Sympy | Giac | Mupad |
|---|---|---|---|---|---|---|---|---|---|
| grade | N/A | A | C | C | F | C | F(-1) | F | F(-1) |
| verified | N/A | Yes | No | Yes | TBD | TBD | TBD | TBD | TBD |
| size | 1141 | 1802 | 698 | 610 | 0 | 1319 | 0 | 0 | 0 |
| N.S. | 1 | 1.58 | 0.61 | 0.53 | 0.00 | 1.16 | 0.00 | 0.00 | 0.00 |
| time (sec) | N/A | 3.981 | 0.407 | 1.385 | 0.000 | 0.373 | 0.000 | 0.000 | 0.000 |

| Problem 112 | Optimal | Rubi | MMA | Maple | Maxima | Fricas | Sympy | Giac | Mupad |
|---|---|---|---|---|---|---|---|---|---|
| grade | N/A | A | C | C | F | C | F(-1) | F | F(-1) |
| verified | N/A | Yes | Yes | Yes | TBD | TBD | TBD | TBD | TBD |
| size | 1161 | 2020 | 675 | 340 | 0 | 1223 | 0 | 0 | 0 |
| N.S. | 1 | 1.74 | 0.58 | 0.29 | 0.00 | 1.05 | 0.00 | 0.00 | 0.00 |
| time (sec) | N/A | 4.163 | 0.317 | 1.049 | 0.000 | 0.325 | 0.000 | 0.000 | 0.000 |

| Problem 113 | Optimal | Rubi | MMA | Maple | Maxima | Fricas | Sympy | Giac | Mupad |
|---|---|---|---|---|---|---|---|---|---|
| grade | N/A | A | C | C | F | C | F(-1) | F | F(-1) |
| verified | N/A | Yes | Yes | Yes | TBD | TBD | TBD | TBD | TBD |
| size | 1163 | 2229 | 2109 | 363 | 0 | 1113 | 0 | 0 | 0 |
| N.S. | 1 | 1.92 | 1.81 | 0.31 | 0.00 | 0.96 | 0.00 | 0.00 | 0.00 |
| time (sec) | N/A | 4.586 | 0.553 | 1.089 | 0.000 | 0.352 | 0.000 | 0.000 | 0.000 |

## 2.3 Detailed conclusion table specific for Rubi results

The following table is specific to Rubi only. It gives additional statistics for each integral. the column **steps** is the number of steps used by Rubi to obtain the antiderivative. The **rules** column is the number of unique rules used. The **integrand size** column is the leaf size of the integrand. Finally the ratio $\frac{\text{number of rules}}{\text{integrand size}}$ is also given. The larger this ratio is, the harder the integral is to solve. In this test file, problem number [36] had the largest ratio of [.7142859999999999976]

Table 2.1: Rubi specific breakdown of results for each integral

| # | grade | number of steps used | number of unique rules | normalized antiderivative leaf size | integrand leaf size | $\frac{\text{number of rules}}{\text{integrand leaf size}}$ |
|---|---|---|---|---|---|---|
| 1 | A | 2 | 2 | 1.00 | 15 | 0.133 |
| 2 | A | 2 | 2 | 1.00 | 15 | 0.133 |
| 3 | A | 2 | 2 | 1.00 | 13 | 0.154 |
| 4 | A | 4 | 4 | 1.00 | 12 | 0.333 |
| 5 | A | 2 | 2 | 1.00 | 15 | 0.133 |
| 6 | A | 2 | 2 | 1.00 | 15 | 0.133 |
| 7 | A | 2 | 2 | 1.00 | 15 | 0.133 |
| 8 | A | 2 | 2 | 1.00 | 15 | 0.133 |
| 9 | A | 2 | 2 | 1.00 | 15 | 0.133 |
| 10 | A | 2 | 2 | 1.00 | 17 | 0.118 |
| 11 | A | 2 | 2 | 1.00 | 15 | 0.133 |
| 12 | A | 7 | 7 | 1.04 | 14 | 0.500 |
| 13 | A | 2 | 2 | 1.00 | 17 | 0.118 |
| 14 | A | 2 | 2 | 1.00 | 17 | 0.118 |
| 15 | A | 2 | 2 | 1.00 | 17 | 0.118 |
| 16 | A | 2 | 2 | 1.00 | 17 | 0.118 |
| 17 | A | 2 | 2 | 1.00 | 17 | 0.118 |
| 18 | A | 2 | 2 | 1.00 | 17 | 0.118 |
| 19 | A | 2 | 2 | 1.00 | 17 | 0.118 |
| 20 | A | 2 | 2 | 1.00 | 17 | 0.118 |
| 21 | A | 2 | 2 | 1.00 | 15 | 0.133 |
| 22 | A | 5 | 5 | 1.00 | 14 | 0.357 |

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Table 2.1 – continued from previous page

| # | grade | number of steps used | number of unique rules | normalized antiderivative leaf size | integrand leaf size | $\frac{\text{number of rules}}{\text{integrand leaf size}}$ |
|---|---|---|---|---|---|---|
| 23 | A | 2 | 2 | 1.00 | 17 | 0.118 |
| 24 | A | 2 | 2 | 1.00 | 17 | 0.118 |
| 25 | A | 2 | 2 | 1.00 | 17 | 0.118 |
| 26 | A | 2 | 2 | 1.00 | 17 | 0.118 |
| 27 | A | 2 | 2 | 1.00 | 17 | 0.118 |
| 28 | A | 2 | 2 | 1.00 | 17 | 0.118 |
| 29 | A | 2 | 2 | 1.00 | 15 | 0.133 |
| 30 | A | 7 | 7 | 1.06 | 14 | 0.500 |
| 31 | A | 2 | 2 | 1.00 | 17 | 0.118 |
| 32 | A | 2 | 2 | 1.00 | 17 | 0.118 |
| 33 | A | 2 | 2 | 1.00 | 17 | 0.118 |
| 34 | A | 2 | 2 | 1.00 | 17 | 0.118 |
| 35 | A | 2 | 2 | 1.00 | 15 | 0.133 |
| 36 | A | 10 | 10 | 1.01 | 14 | 0.714 |
| 37 | A | 2 | 2 | 1.00 | 17 | 0.118 |
| 38 | A | 2 | 2 | 1.00 | 17 | 0.118 |
| 39 | A | 2 | 2 | 1.00 | 17 | 0.118 |
| 40 | A | 2 | 2 | 1.00 | 17 | 0.118 |
| 41 | A | 2 | 2 | 1.00 | 17 | 0.118 |
| 42 | A | 2 | 2 | 1.00 | 15 | 0.133 |
| 43 | A | 2 | 2 | 1.00 | 14 | 0.143 |
| 44 | A | 2 | 2 | 1.00 | 17 | 0.118 |
| 45 | A | 2 | 2 | 1.00 | 17 | 0.118 |
| 46 | A | 2 | 2 | 1.00 | 17 | 0.118 |
| 47 | A | 2 | 2 | 1.00 | 17 | 0.118 |
| 48 | A | 2 | 2 | 1.00 | 17 | 0.118 |
| 49 | A | 2 | 2 | 1.00 | 19 | 0.105 |
| 50 | A | 2 | 2 | 1.00 | 17 | 0.118 |
| 51 | A | 2 | 2 | 1.00 | 16 | 0.125 |
| 52 | A | 2 | 2 | 1.00 | 19 | 0.105 |
| 53 | A | 2 | 2 | 1.00 | 19 | 0.105 |
| 54 | A | 2 | 2 | 1.00 | 19 | 0.105 |
| 55 | A | 2 | 2 | 1.00 | 19 | 0.105 |
| 56 | A | 2 | 2 | 1.00 | 19 | 0.105 |

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Table 2.1 – continued from previous page

| # | grade | number of steps used | number of unique rules | normalized antiderivative leaf size | integrand leaf size | $\frac{\text{number of rules}}{\text{integrand leaf size}}$ |
|---|---|---|---|---|---|---|
| 57 | A | 2 | 2 | 1.00 | 19 | 0.105 |
| 58 | A | 2 | 2 | 1.00 | 19 | 0.105 |
| 59 | A | 2 | 2 | 1.00 | 19 | 0.105 |
| 60 | A | 2 | 2 | 1.00 | 17 | 0.118 |
| 61 | A | 2 | 2 | 1.00 | 16 | 0.125 |
| 62 | A | 2 | 2 | 1.00 | 19 | 0.105 |
| 63 | A | 2 | 2 | 1.00 | 19 | 0.105 |
| 64 | A | 2 | 2 | 1.00 | 19 | 0.105 |
| 65 | A | 5 | 5 | 1.06 | 19 | 0.263 |
| 66 | A | 5 | 5 | 1.02 | 19 | 0.263 |
| 67 | A | 5 | 5 | 1.03 | 19 | 0.263 |
| 68 | A | 3 | 3 | 1.02 | 17 | 0.176 |
| 69 | A | 2 | 2 | 1.00 | 16 | 0.125 |
| 70 | A | 2 | 2 | 1.00 | 19 | 0.105 |
| 71 | A | 2 | 2 | 1.00 | 19 | 0.105 |
| 72 | A | 9 | 9 | 1.50 | 19 | 0.474 |
| 73 | A | 6 | 6 | 1.02 | 19 | 0.316 |
| 74 | A | 3 | 3 | 0.99 | 17 | 0.176 |
| 75 | A | 2 | 2 | 1.00 | 16 | 0.125 |
| 76 | A | 2 | 2 | 1.00 | 19 | 0.105 |
| 77 | A | 2 | 2 | 1.00 | 19 | 0.105 |
| 78 | A | 2 | 2 | 1.00 | 19 | 0.105 |
| 79 | A | 2 | 2 | 1.00 | 17 | 0.118 |
| 80 | A | 2 | 2 | 1.00 | 17 | 0.118 |
| 81 | A | 2 | 2 | 1.00 | 15 | 0.133 |
| 82 | A | 2 | 2 | 1.00 | 14 | 0.143 |
| 83 | A | 2 | 2 | 1.00 | 17 | 0.118 |
| 84 | A | 2 | 2 | 1.00 | 17 | 0.118 |
| 85 | A | 2 | 2 | 1.00 | 17 | 0.118 |
| 86 | A | 2 | 2 | 1.00 | 17 | 0.118 |
| 87 | A | 2 | 2 | 1.00 | 17 | 0.118 |
| 88 | A | 2 | 2 | 1.00 | 16 | 0.125 |
| 89 | A | 2 | 2 | 1.00 | 19 | 0.105 |
| 90 | A | 2 | 2 | 1.00 | 19 | 0.105 |

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Table 2.1 – continued from previous page

| # | grade | number of steps used | number of unique rules | normalized antiderivative leaf size | integrand leaf size | $\frac{\text{number of rules}}{\text{integrand leaf size}}$ |
|---|---|---|---|---|---|---|
| 91 | A | 2 | 2 | 1.00 | 19 | 0.105 |
| 92 | A | 2 | 2 | 1.00 | 19 | 0.105 |
| 93 | A | 2 | 2 | 1.00 | 19 | 0.105 |
| 94 | A | 2 | 2 | 1.00 | 19 | 0.105 |
| 95 | A | 2 | 2 | 1.00 | 19 | 0.105 |
| 96 | A | 2 | 2 | 1.00 | 19 | 0.105 |
| 97 | A | 2 | 2 | 1.00 | 17 | 0.118 |
| 98 | A | 2 | 2 | 1.00 | 16 | 0.125 |
| 99 | A | 2 | 2 | 1.00 | 19 | 0.105 |
| 100 | A | 2 | 2 | 1.00 | 19 | 0.105 |
| 101 | A | 2 | 2 | 1.00 | 19 | 0.105 |
| 102 | A | 5 | 5 | 1.02 | 19 | 0.263 |
| 103 | A | 3 | 3 | 1.01 | 19 | 0.158 |
| 104 | A | 5 | 5 | 1.05 | 17 | 0.294 |
| 105 | A | 5 | 5 | 1.13 | 16 | 0.312 |
| 106 | A | 5 | 5 | 1.22 | 19 | 0.263 |
| 107 | A | 5 | 5 | 1.29 | 19 | 0.263 |
| 108 | A | 5 | 5 | 1.32 | 19 | 0.263 |
| 109 | B | 7 | 7 | 2.06 | 19 | 0.368 |
| 110 | A | 6 | 6 | 1.11 | 19 | 0.316 |
| 111 | A | 7 | 7 | 1.58 | 17 | 0.412 |
| 112 | A | 7 | 7 | 1.74 | 16 | 0.438 |
| 113 | A | 7 | 7 | 1.92 | 19 | 0.368 |

# CHAPTER 3

## LISTING OF INTEGRALS

# 3.1 $\int x^3(a+bx)\sin(c+dx)\,dx$



## 3.1.1 Optimal result

Integrand size = 15, antiderivative size = 126

$$\int x^3(a+bx)\sin(c+dx)\,dx = -\frac{24b\cos(c+dx)}{d^5}+\frac{6ax\cos(c+dx)}{d^3}+\frac{12bx^2\cos(c+dx)}{d^3}-\frac{ax^3\cos(c+dx)}{d}-\frac{bx^4\cos(c+dx)}{d}-\frac{6a\sin(c+dx)}{d^4}-\frac{24bx\sin(c+dx)}{d^4}+\frac{3ax^2\sin(c+dx)}{d^2}+\frac{4bx^3\sin(c+dx)}{d^2}$$

output
```
-24*b*cos(d*x+c)/d^5+6*a*x*cos(d*x+c)/d^3+12*b*x^2*cos(d*x+c)/d^3-a*x^3*co
s(d*x+c)/d-b*x^4*cos(d*x+c)/d-6*a*sin(d*x+c)/d^4-24*b*x*sin(d*x+c)/d^4+3*a
*x^2*sin(d*x+c)/d^2+4*b*x^3*sin(d*x+c)/d^2
```

## 3.1.2 Mathematica [A] (verified)

Time = 0.15 (sec) , antiderivative size = 82, normalized size of antiderivative = 0.65

$$\int x^3(a+bx)\sin(c+dx)\,dx = \frac{-((ad^2x(-6+d^2x^2)+b(24-12d^2x^2+d^4x^4))\cos(c+dx))+d(4bx(-6+d^2x^2)+3a(-2+d^2x^2))\sin(c}{d^5}$$

input
```
Integrate[x^3*(a + b*x)*Sin[c + d*x],x]
```

output
```
(-((a*d^2*x*(-6 + d^2*x^2) + b*(24 - 12*d^2*x^2 + d^4*x^4))*Cos[c + d*x])
+ d*(4*b*x*(-6 + d^2*x^2) + 3*a*(-2 + d^2*x^2))*Sin[c + d*x])/d^5
```

### 3.1.3 Rubi [A] (verified)

Time = 0.46 (sec) , antiderivative size = 126, normalized size of antiderivative = 1.00, number of steps used = 2, number of rules used = 2, $\frac{\text{number of rules}}{\text{integrand size}}$ = 0.133, Rules used = {7293, 2009}

Below are the steps used by Rubi to obtain the solution. The rule number used for the transformation is given above next to the arrow. The rules definitions used are listed below.

$$\int x^3(a+bx)\sin(c+dx)\,dx$$

$$\Big\downarrow \text{7293}$$

$$\int \left(ax^3\sin(c+dx)+bx^4\sin(c+dx)\right)dx$$

$$\Big\downarrow \text{2009}$$

$$-\frac{6a\sin(c+dx)}{d^4}+\frac{6ax\cos(c+dx)}{d^3}+\frac{3ax^2\sin(c+dx)}{d^2}-\frac{ax^3\cos(c+dx)}{d}-\frac{24b\cos(c+dx)}{d^5}-\frac{24bx\sin(c+dx)}{d^4}+\frac{12bx^2\cos(c+dx)}{d^3}+\frac{4bx^3\sin(c+dx)}{d^2}-\frac{bx^4\cos(c+dx)}{d}$$

input
```
Int[x^3*(a + b*x)*Sin[c + d*x],x]
```

output
```
(-24*b*Cos[c + d*x])/d^5 + (6*a*x*Cos[c + d*x])/d^3 + (12*b*x^2*Cos[c + d*
x])/d^3 - (a*x^3*Cos[c + d*x])/d - (b*x^4*Cos[c + d*x])/d - (6*a*Sin[c + d
*x])/d^4 - (24*b*x*Sin[c + d*x])/d^4 + (3*a*x^2*Sin[c + d*x])/d^2 + (4*b*x
^3*Sin[c + d*x])/d^2
```

#### 3.1.3.1 Defintions of rubi rules used

rule 2009
```
Int[u_, x_Symbol] :> Simp[IntSum[u, x], x] /; SumQ[u]
```

rule 7293
```
Int[u_, x_Symbol] :> With[{v = ExpandIntegrand[u, x]}, Int[v, x] /; SumQ[v]
]
```

### 3.1.4 Maple [A] (verified)

Time = 0.16 (sec) , antiderivative size = 85, normalized size of antiderivative = 0.67

| method | result |
|---|---|
| risch | $-\frac{(b x^4 d^4+a d^4 x^3-12 d^2 x^2 b-6 a d^2 x+24 b)\cos(dx+c)}{d^5}+\frac{(4 b d^2 x^3+3 a d^2 x^2-24 b x-6 a)\sin(dx+c)}{d^4}$ |
| parallelrisch | $\frac{(x^2(bx+a)d^2-12bx-6a)x d^2\left(\tan^2\left(\frac{dx}{2}+\frac{c}{2}\right)\right)+6\left(x^2\left(\frac{4bx}{3}+a\right)d^2-8bx-2a\right)d\tan\left(\frac{dx}{2}+\frac{c}{2}\right)+(-b x^4-a x^3)d^4+6x(2bx+}{d^5\left(1+\tan^2\left(\frac{dx}{2}+\frac{c}{2}\right)\right)}$ |
| norman | $\frac{\frac{a x^3\left(\tan^2\left(\frac{dx}{2}+\frac{c}{2}\right)\right)}{d}+\frac{b x^4\left(\tan^2\left(\frac{dx}{2}+\frac{c}{2}\right)\right)}{d}-\frac{48b}{d^5}-\frac{12a\tan\left(\frac{dx}{2}+\frac{c}{2}\right)}{d^4}+\frac{6ax}{d^3}-\frac{a x^3}{d}+\frac{12b x^2}{d^3}-\frac{b x^4}{d}-\frac{6ax\left(\tan^2\left(\frac{dx}{2}+\frac{c}{2}\right)\right)}{d^3}+\frac{6a x^2 \tan}{}}{1+\tan^2\left(\frac{dx}{2}+\frac{c}{2}\right)}$ |
| meijerg | $\frac{16b\sqrt{\pi}\sin(c)\left(-\frac{x(d^2)^{\frac{5}{2}}\left(-\frac{5d^2x^2}{2}+15\right)\cos(dx)}{10\sqrt{\pi}\,d^4}+\frac{(d^2)^{\frac{5}{2}}\left(\frac{5}{8}d^4x^4-\frac{15}{2}d^2x^2+15\right)\sin(dx)}{10\sqrt{\pi}\,d^5}\right)}{d^4\sqrt{d^2}}+\frac{16b\sqrt{\pi}\cos(c)\left(\frac{3}{2\sqrt{\pi}}-\frac{\left(\frac{3}{8}d^4x^4\right.}{}\right.}{}$ |
| parts | $-\frac{b x^4\cos(dx+c)}{d}-\frac{a x^3\cos(dx+c)}{d}+\frac{\frac{3a c^2\sin(dx+c)}{d^2}-\frac{6ac(\cos(dx+c)+(dx+c)\sin(dx+c))}{d^2}+\frac{3a\left((dx+c)^2\sin(dx+c)-2\sin(d\right.}{d^2}}{}$ |
| derivativedivides | $\frac{a c^3\cos(dx+c)+3a c^2(\sin(dx+c)-\cos(dx+c)(dx+c))-3ac\left(-(dx+c)^2\cos(dx+c)+2\cos(dx+c)+2(dx+c)\sin(dx+c)\right)+a}{}$ |
| default | $\frac{a c^3\cos(dx+c)+3a c^2(\sin(dx+c)-\cos(dx+c)(dx+c))-3ac\left(-(dx+c)^2\cos(dx+c)+2\cos(dx+c)+2(dx+c)\sin(dx+c)\right)+a}{}$ |

input
```
int(x^3*(b*x+a)*sin(d*x+c),x,method=_RETURNVERBOSE)
```

output
```
-(b*d^4*x^4+a*d^4*x^3-12*b*d^2*x^2-6*a*d^2*x+24*b)/d^5*cos(d*x+c)+1/d^4*(4
*b*d^2*x^3+3*a*d^2*x^2-24*b*x-6*a)*sin(d*x+c)
```

### 3.1.5 Fricas [A] (verification not implemented)

Time = 0.29 (sec) , antiderivative size = 85, normalized size of antiderivative = 0.67

$$\int x^3(a+bx)\sin(c+dx)\,dx = -\frac{(bd^4x^4+ad^4x^3-12\,bd^2x^2-6\,ad^2x+24\,b)\cos(dx+c)-(4\,bd^3x^3+3\,ad^3x^2-24\,bdx-6\,ad)\sin(dx+}{d^5}$$

input
```
integrate(x^3*(b*x+a)*sin(d*x+c),x, algorithm="fricas")
```

output
```
-((b*d^4*x^4 + a*d^4*x^3 - 12*b*d^2*x^2 - 6*a*d^2*x + 24*b)*cos(d*x + c) -
 (4*b*d^3*x^3 + 3*a*d^3*x^2 - 24*b*d*x - 6*a*d)*sin(d*x + c))/d^5
```

### 3.1.6 Sympy [A] (verification not implemented)

Time = 0.31 (sec) , antiderivative size = 151, normalized size of antiderivative = 1.20

$$\int x^3(a+bx)\sin(c+dx)\,dx$$
$$=\begin{cases} -\frac{ax^3\cos(c+dx)}{d}+\frac{3ax^2\sin(c+dx)}{d^2}+\frac{6ax\cos(c+dx)}{d^3}-\frac{6a\sin(c+dx)}{d^4}-\frac{bx^4\cos(c+dx)}{d}+\frac{4bx^3\sin(c+dx)}{d^2}+\frac{12bx^2\cos(c+dx)}{d^3}- \\ \left(\frac{ax^4}{4}+\frac{bx^5}{5}\right)\sin(c) \end{cases}$$

input
```
integrate(x**3*(b*x+a)*sin(d*x+c),x)
```

output
```
Piecewise((-a*x**3*cos(c + d*x)/d + 3*a*x**2*sin(c + d*x)/d**2 + 6*a*x*cos
(c + d*x)/d**3 - 6*a*sin(c + d*x)/d**4 - b*x**4*cos(c + d*x)/d + 4*b*x**3*
sin(c + d*x)/d**2 + 12*b*x**2*cos(c + d*x)/d**3 - 24*b*x*sin(c + d*x)/d**4
 - 24*b*cos(c + d*x)/d**5, Ne(d, 0)), ((a*x**4/4 + b*x**5/5)*sin(c), True)
)
```

### 3.1.7 Maxima [B] (verification not implemented)

Leaf count of result is larger than twice the leaf count of optimal. 306 vs. 2(126) = 252.

Time = 0.23 (sec) , antiderivative size = 306, normalized size of antiderivative = 2.43

$$\int x^3(a+bx)\sin(c+dx)\,dx$$
$$=\frac{ac^3\cos(dx+c)-\frac{bc^4\cos(dx+c)}{d}-3((dx+c)\cos(dx+c)-\sin(dx+c))ac^2+\frac{4((dx+c)\cos(dx+c)-\sin(dx+c))bc^3}{d}-}{}$$

input
```
integrate(x^3*(b*x+a)*sin(d*x+c),x, algorithm="maxima")
```

output
```
(a*c^3*cos(d*x + c) - b*c^4*cos(d*x + c)/d - 3*((d*x + c)*cos(d*x + c) - s
in(d*x + c))*a*c^2 + 4*((d*x + c)*cos(d*x + c) - sin(d*x + c))*b*c^3/d + 3
*(((d*x + c)^2 - 2)*cos(d*x + c) - 2*(d*x + c)*sin(d*x + c))*a*c - 6*(((d*
x + c)^2 - 2)*cos(d*x + c) - 2*(d*x + c)*sin(d*x + c))*b*c^2/d - (((d*x +
c)^3 - 6*d*x - 6*c)*cos(d*x + c) - 3*((d*x + c)^2 - 2)*sin(d*x + c))*a + 4
*(((d*x + c)^3 - 6*d*x - 6*c)*cos(d*x + c) - 3*((d*x + c)^2 - 2)*sin(d*x +
 c))*b*c/d - (((d*x + c)^4 - 12*(d*x + c)^2 + 24)*cos(d*x + c) - 4*((d*x +
 c)^3 - 6*d*x - 6*c)*sin(d*x + c))*b/d)/d^4
```

### 3.1.8 Giac [A] (verification not implemented)

Time = 0.29 (sec) , antiderivative size = 86, normalized size of antiderivative = 0.68

$$\int x^3(a+bx)\sin(c+dx)\,dx = -\frac{(bd^4x^4+ad^4x^3-12\,bd^2x^2-6\,ad^2x+24\,b)\cos(dx+c)}{d^5} + \frac{(4\,bd^3x^3+3\,ad^3x^2-24\,bdx-6\,ad)\sin(dx+c)}{d^5}$$

input
```
integrate(x^3*(b*x+a)*sin(d*x+c),x, algorithm="giac")
```

output
```
-(b*d^4*x^4 + a*d^4*x^3 - 12*b*d^2*x^2 - 6*a*d^2*x + 24*b)*cos(d*x + c)/d^
5 + (4*b*d^3*x^3 + 3*a*d^3*x^2 - 24*b*d*x - 6*a*d)*sin(d*x + c)/d^5
```

### 3.1.9 Mupad [B] (verification not implemented)

Time = 0.34 (sec) , antiderivative size = 122, normalized size of antiderivative = 0.97

$$\int x^3(a+bx)\sin(c+dx)\,dx = \frac{6\,a\,x\,\cos(c+d\,x)+12\,b\,x^2\,\cos(c+d\,x)}{d^3} - \frac{6\,a\,\sin(c+d\,x)+24\,b\,x\,\sin(c+d\,x)}{d^4} - \frac{a\,x^3\,\cos(c+d\,x)+b\,x^4\,\cos(c+d\,x)}{d} + \frac{3\,a\,x^2\,\sin(c+d\,x)+4\,b\,x^3\,\sin(c+d\,x)}{d^2} - \frac{24\,b\,\cos(c+d\,x)}{d^5}$$

input
```
int(x^3*sin(c + d*x)*(a + b*x),x)
```

output
```
(6*a*x*cos(c + d*x) + 12*b*x^2*cos(c + d*x))/d^3 - (6*a*sin(c + d*x) + 24*
b*x*sin(c + d*x))/d^4 - (a*x^3*cos(c + d*x) + b*x^4*cos(c + d*x))/d + (3*a
*x^2*sin(c + d*x) + 4*b*x^3*sin(c + d*x))/d^2 - (24*b*cos(c + d*x))/d^5
```

# 3.2 $\int x^2(a+bx)\sin(c+dx)\,dx$



## 3.2.1 Optimal result

Integrand size = 15, antiderivative size = 96

$$\int x^2(a+bx)\sin(c+dx)\,dx = \frac{2a\cos(c+dx)}{d^3}+\frac{6bx\cos(c+dx)}{d^3}-\frac{ax^2\cos(c+dx)}{d} -\frac{bx^3\cos(c+dx)}{d}-\frac{6b\sin(c+dx)}{d^4} +\frac{2ax\sin(c+dx)}{d^2}+\frac{3bx^2\sin(c+dx)}{d^2}$$

output
```
2*a*cos(d*x+c)/d^3+6*b*x*cos(d*x+c)/d^3-a*x^2*cos(d*x+c)/d-b*x^3*cos(d*x+c
)/d-6*b*sin(d*x+c)/d^4+2*a*x*sin(d*x+c)/d^2+3*b*x^2*sin(d*x+c)/d^2
```

## 3.2.2 Mathematica [A] (verified)

Time = 0.13 (sec) , antiderivative size = 65, normalized size of antiderivative = 0.68

$$\int x^2(a+bx)\sin(c+dx)\,dx = \frac{-d(bx(-6+d^2x^2)+a(-2+d^2x^2))\cos(c+dx)+(2ad^2x+3b(-2+d^2x^2))\sin(c+dx)}{d^4}$$

input
```
Integrate[x^2*(a + b*x)*Sin[c + d*x],x]
```

output
```
(-(d*(b*x*(-6 + d^2*x^2) + a*(-2 + d^2*x^2))*Cos[c + d*x]) + (2*a*d^2*x +
3*b*(-2 + d^2*x^2))*Sin[c + d*x])/d^4
```

### 3.2.3 Rubi [A] (verified)

Time = 0.39 (sec) , antiderivative size = 96, normalized size of antiderivative = 1.00, number of steps used = 2, number of rules used = 2, $\frac{\text{number of rules}}{\text{integrand size}} = 0.133$, Rules used = {7293, 2009}

Below are the steps used by Rubi to obtain the solution. The rule number used for the transformation is given above next to the arrow. The rules definitions used are listed below.

$$\int x^2(a+bx)\sin(c+dx)\,dx$$

$$\Big\downarrow \text{7293}$$

$$\int \left(ax^2\sin(c+dx)+bx^3\sin(c+dx)\right)dx$$

$$\Big\downarrow \text{2009}$$

$$\frac{2a\cos(c+dx)}{d^3}+\frac{2ax\sin(c+dx)}{d^2}-\frac{ax^2\cos(c+dx)}{d}-\frac{6b\sin(c+dx)}{d^4}+\frac{6bx\cos(c+dx)}{d^3}+\frac{3bx^2\sin(c+dx)}{d^2}-\frac{bx^3\cos(c+dx)}{d}$$

input
```
Int[x^2*(a + b*x)*Sin[c + d*x],x]
```

output
```
(2*a*Cos[c + d*x])/d^3 + (6*b*x*Cos[c + d*x])/d^3 - (a*x^2*Cos[c + d*x])/d
 - (b*x^3*Cos[c + d*x])/d - (6*b*Sin[c + d*x])/d^4 + (2*a*x*Sin[c + d*x])/
d^2 + (3*b*x^2*Sin[c + d*x])/d^2
```

#### 3.2.3.1 Defintions of rubi rules used

rule 2009
```
Int[u_, x_Symbol] :> Simp[IntSum[u, x], x] /; SumQ[u]
```

rule 7293
```
Int[u_, x_Symbol] :> With[{v = ExpandIntegrand[u, x]}, Int[v, x] /; SumQ[v]
]
```

### 3.2.4 Maple [A] (verified)

Time = 0.14 (sec) , antiderivative size = 67, normalized size of antiderivative = 0.70

| method | result |
|---|---|
| risch | $-\frac{\left(b\,d^{2} x^{3}+a\,d^{2} x^{2}-6 b x -2 a \right) \cos \left(d x +c \right)}{d^{3}}+\frac{\left(3 d^{2} x^{2} b +2 a\,d^{2} x -6 b \right) \sin \left(d x +c \right)}{d^{4}}$ |
| parallelrisch | $\frac{x \left(x \left(b x +a \right) d^{2}-6 b \right) d \left(\tan^{2}\left(\frac{d x}{2}+\frac{c}{2}\right)\right)+\left(\left(6 b\,x^{2}+4 a x \right) d^{2}-12 b \right) \tan \left(\frac{d x}{2}+\frac{c}{2}\right)-\left(x^{2} \left(b x +a \right) d^{2}-6 b x -4 a \right) d}{d^{4} \left(1+\tan^{2}\left(\frac{d x}{2}+\frac{c}{2}\right)\right)}$ |
| norman | $\frac{\frac{4 a}{d^{3}}+\frac{a\,x^{2} \left(\tan^{2}\left(\frac{d x}{2}+\frac{c}{2}\right)\right)}{d}+\frac{b\,x^{3} \left(\tan^{2}\left(\frac{d x}{2}+\frac{c}{2}\right)\right)}{d}-\frac{a\,x^{2}}{d}-\frac{12 b \tan \left(\frac{d x}{2}+\frac{c}{2}\right)}{d^{4}}+\frac{6 b x}{d^{3}}-\frac{b\,x^{3}}{d}+\frac{4 a x \tan \left(\frac{d x}{2}+\frac{c}{2}\right)}{d^{2}}-\frac{6 b x \left(\tan^{2}\left(\frac{d x}{2}+\frac{c}{2}\right)\right)}{d^{3}}+}{1+\tan^{2}\left(\frac{d x}{2}+\frac{c}{2}\right)}$ |
| parts | $-\frac{b\,x^{3} \cos \left(d x +c \right)}{d}-\frac{a\,x^{2} \cos \left(d x +c \right)}{d}+\frac{-\frac{2 a c \sin \left(d x +c \right)}{d}+\frac{2 a \left(\cos \left(d x +c \right)+\left(d x +c \right) \sin \left(d x +c \right)\right)}{d}+\frac{3 b\,c^{2} \sin \left(d x +c \right)}{d^{2}}-\frac{6 b c (\cos (d x +c}{}}{d^{2}}$ |
| meijerg | $\frac{8 b \sqrt{\pi}\, \sin \left(c \right) \left(\frac{3}{4 \sqrt{\pi}}-\frac{\left(-\frac{3 d^{2} x^{2}}{2}+3\right) \cos \left(d x \right)}{4 \sqrt{\pi}}-\frac{d x \left(-\frac{d^{2} x^{2}}{2}+3\right) \sin \left(d x \right)}{4 \sqrt{\pi}}\right)}{d^{4}}+\frac{8 b \sqrt{\pi}\, \cos \left(c \right) \left(\frac{x d \left(-\frac{5 d^{2} x^{2}}{2}+15\right) \cos \left(d x \right)}{20 \sqrt{\pi}}-\frac{(-\frac{15 d}{}}{}\right)}{d^{4}}$ |
| derivativedivides | $-a\,c^{2} \cos \left(d x +c \right)-2 a c \left(\sin \left(d x +c \right)-\cos \left(d x +c \right) \left(d x +c \right)\right)+a \left(-\left(d x +c \right)^{2} \cos \left(d x +c \right)+2 \cos \left(d x +c \right)+2 \left(d x +c \right) \sin \left(d x +c \right)\right)+\frac{b\,c}{}$ |
| default | $-a\,c^{2} \cos \left(d x +c \right)-2 a c \left(\sin \left(d x +c \right)-\cos \left(d x +c \right) \left(d x +c \right)\right)+a \left(-\left(d x +c \right)^{2} \cos \left(d x +c \right)+2 \cos \left(d x +c \right)+2 \left(d x +c \right) \sin \left(d x +c \right)\right)+\frac{b\,c}{}$ |

input
```
int(x^2*(b*x+a)*sin(d*x+c),x,method=_RETURNVERBOSE)
```

output
```
-1/d^3*(b*d^2*x^3+a*d^2*x^2-6*b*x-2*a)*cos(d*x+c)+(3*b*d^2*x^2+2*a*d^2*x-6
*b)/d^4*sin(d*x+c)
```

### 3.2.5 Fricas [A] (verification not implemented)

Time = 0.28 (sec) , antiderivative size = 67, normalized size of antiderivative = 0.70

$$\int x^2(a+bx)\sin(c+dx)\,dx = -\frac{(bd^3x^3+ad^3x^2-6\,bdx-2\,ad)\cos{(dx+c)}-(3\,bd^2x^2+2\,ad^2x-6\,b)\sin{(dx+c)}}{d^4}$$

input
```
integrate(x^2*(b*x+a)*sin(d*x+c),x, algorithm="fricas")
```

output
```
-((b*d^3*x^3 + a*d^3*x^2 - 6*b*d*x - 2*a*d)*cos(d*x + c) - (3*b*d^2*x^2 +
2*a*d^2*x - 6*b)*sin(d*x + c))/d^4
```

### 3.2.6 Sympy [A] (verification not implemented)

Time = 0.24 (sec) , antiderivative size = 117, normalized size of antiderivative = 1.22

$$\int x^2(a+bx)\sin(c+dx)\,dx$$
$$= \begin{cases} -\frac{ax^2\cos{(c+dx)}}{d} + \frac{2ax\sin{(c+dx)}}{d^2} + \frac{2a\cos{(c+dx)}}{d^3} - \frac{bx^3\cos{(c+dx)}}{d} + \frac{3bx^2\sin{(c+dx)}}{d^2} + \frac{6bx\cos{(c+dx)}}{d^3} - \frac{6b\sin{(c+dx)}}{d^4} & \text{for } d \\ \left(\frac{ax^3}{3} + \frac{bx^4}{4}\right)\sin{(c)} & \text{other} \end{cases}$$

input
```
integrate(x**2*(b*x+a)*sin(d*x+c),x)
```

output
```
Piecewise((-a*x**2*cos(c + d*x)/d + 2*a*x*sin(c + d*x)/d**2 + 2*a*cos(c +
d*x)/d**3 - b*x**3*cos(c + d*x)/d + 3*b*x**2*sin(c + d*x)/d**2 + 6*b*x*cos
(c + d*x)/d**3 - 6*b*sin(c + d*x)/d**4, Ne(d, 0)), ((a*x**3/3 + b*x**4/4)*
sin(c), True))
```

### 3.2.7 Maxima [B] (verification not implemented)

Leaf count of result is larger than twice the leaf count of optimal. 201 vs. 2(96) = 192.

Time = 0.21 (sec) , antiderivative size = 201, normalized size of antiderivative = 2.09

$$\int x^2(a+bx)\sin(c+dx)\,dx =$$

$$-\frac{ac^2\cos{(dx+c)} - \frac{bc^3\cos(dx+c)}{d} - 2\left((dx+c)\cos{(dx+c)} - \sin{(dx+c)}\right)ac + \frac{3\left((dx+c)\cos(dx+c)-\sin(dx+c)\right)bc^2}{d}}{}$$

input
```
integrate(x^2*(b*x+a)*sin(d*x+c),x, algorithm="maxima")
```

output
```
-(a*c^2*cos(d*x + c) - b*c^3*cos(d*x + c)/d - 2*((d*x + c)*cos(d*x + c) -
sin(d*x + c))*a*c + 3*((d*x + c)*cos(d*x + c) - sin(d*x + c))*b*c^2/d + ((
(d*x + c)^2 - 2)*cos(d*x + c) - 2*(d*x + c)*sin(d*x + c))*a - 3*(((d*x + c
)^2 - 2)*cos(d*x + c) - 2*(d*x + c)*sin(d*x + c))*b*c/d + (((d*x + c)^3 -
6*d*x - 6*c)*cos(d*x + c) - 3*((d*x + c)^2 - 2)*sin(d*x + c))*b/d)/d^3
```

### 3.2.8 Giac [A] (verification not implemented)

Time = 0.28 (sec) , antiderivative size = 68, normalized size of antiderivative = 0.71

$$\int x^2(a+bx)\sin(c+dx)\,dx = -\frac{(bd^3x^3+ad^3x^2-6\,bdx-2\,ad)\cos(dx+c)}{d^4} + \frac{(3\,bd^2x^2+2\,ad^2x-6\,b)\sin(dx+c)}{d^4}$$

input
```
integrate(x^2*(b*x+a)*sin(d*x+c),x, algorithm="giac")
```

output
```
-(b*d^3*x^3 + a*d^3*x^2 - 6*b*d*x - 2*a*d)*cos(d*x + c)/d^4 + (3*b*d^2*x^2
 + 2*a*d^2*x - 6*b)*sin(d*x + c)/d^4
```

### 3.2.9 Mupad [B] (verification not implemented)

Time = 0.20 (sec) , antiderivative size = 92, normalized size of antiderivative = 0.96

$$\int x^2(a+bx)\sin(c+dx)\,dx = \frac{3\,b\,x^2\,\sin(c+d\,x)+2\,a\,x\,\sin(c+d\,x)}{d^2} + \frac{2\,a\,\cos(c+d\,x)+6\,b\,x\,\cos(c+d\,x)}{d^3} - \frac{a\,x^2\,\cos(c+d\,x)+b\,x^3\,\cos(c+d\,x)}{d} - \frac{6\,b\,\sin(c+d\,x)}{d^4}$$

input
```
int(x^2*sin(c + d*x)*(a + b*x),x)
```

output
```
(3*b*x^2*sin(c + d*x) + 2*a*x*sin(c + d*x))/d^2 + (2*a*cos(c + d*x) + 6*b*
x*cos(c + d*x))/d^3 - (a*x^2*cos(c + d*x) + b*x^3*cos(c + d*x))/d - (6*b*s
in(c + d*x))/d^4
```

# 3.3 $\int x(a+bx)\sin(c+dx)\,dx$



## 3.3.1 Optimal result

Integrand size = 13, antiderivative size = 65

$$\int x(a+bx)\sin(c+dx)\,dx = \frac{2b\cos(c+dx)}{d^3} - \frac{ax\cos(c+dx)}{d} - \frac{bx^2\cos(c+dx)}{d} + \frac{a\sin(c+dx)}{d^2} + \frac{2bx\sin(c+dx)}{d^2}$$

output
```
2*b*cos(d*x+c)/d^3-a*x*cos(d*x+c)/d-b*x^2*cos(d*x+c)/d+a*sin(d*x+c)/d^2+2*
b*x*sin(d*x+c)/d^2
```

## 3.3.2 Mathematica [A] (verified)

Time = 0.11 (sec) , antiderivative size = 45, normalized size of antiderivative = 0.69

$$\int x(a+bx)\sin(c+dx)\,dx = \frac{-((ad^2x+b(-2+d^2x^2))\cos(c+dx))+d(a+2bx)\sin(c+dx)}{d^3}$$

input
```
Integrate[x*(a + b*x)*Sin[c + d*x],x]
```

output
```
(-((a*d^2*x + b*(-2 + d^2*x^2))*Cos[c + d*x]) + d*(a + 2*b*x)*Sin[c + d*x]
)/d^3
```

### 3.3.3 Rubi [A] (verified)

Time = 0.29 (sec) , antiderivative size = 65, normalized size of antiderivative = 1.00, number of steps used = 2, number of rules used = 2, $\frac{\text{number of rules}}{\text{integrand size}} = 0.154$, Rules used = {7293, 2009}

Below are the steps used by Rubi to obtain the solution. The rule number used for the transformation is given above next to the arrow. The rules definitions used are listed below.

$$\int x(a+bx)\sin(c+dx)\,dx$$

$$\Big\downarrow \text{7293}$$

$$\int \left(ax\sin(c+dx)+bx^2\sin(c+dx)\right)dx$$

$$\Big\downarrow \text{2009}$$

$$\frac{a\sin(c+dx)}{d^2}-\frac{ax\cos(c+dx)}{d}+\frac{2b\cos(c+dx)}{d^3}+\frac{2bx\sin(c+dx)}{d^2}-\frac{bx^2\cos(c+dx)}{d}$$

input
```
Int[x*(a + b*x)*Sin[c + d*x],x]
```

output
```
(2*b*Cos[c + d*x])/d^3 - (a*x*Cos[c + d*x])/d - (b*x^2*Cos[c + d*x])/d + (
a*Sin[c + d*x])/d^2 + (2*b*x*Sin[c + d*x])/d^2
```

#### 3.3.3.1 Defintions of rubi rules used

rule 2009
```
Int[u_, x_Symbol] :> Simp[IntSum[u, x], x] /; SumQ[u]
```

rule 7293
```
Int[u_, x_Symbol] :> With[{v = ExpandIntegrand[u, x]}, Int[v, x] /; SumQ[v]
]
```

### 3.3.4 Maple [A] (verified)

Time = 0.14 (sec) , antiderivative size = 47, normalized size of antiderivative = 0.72

| method | result |
|---|---|
| risch | $-\frac{(d^2x^2b+a\,d^2x-2b)\cos(dx+c)}{d^3}+\frac{(2bx+a)\sin(dx+c)}{d^2}$ |
| parallelrisch | $\frac{(x(bx+a)d^2-4b)\left(\tan^2\left(\frac{dx}{2}+\frac{c}{2}\right)\right)+2d(2bx+a)\tan\left(\frac{dx}{2}+\frac{c}{2}\right)-x(bx+a)d^2}{d^3\left(1+\tan^2\left(\frac{dx}{2}+\frac{c}{2}\right)\right)}$ |
| parts | $-\frac{b\,x^2\cos(dx+c)}{d}-\frac{ax\cos(dx+c)}{d}+\frac{a\sin(dx+c)-\frac{2bc\sin(dx+c)}{d}+\frac{2b(\cos(dx+c)+(dx+c)\sin(dx+c))}{d}}{d^2}$ |
| norman | $\frac{\frac{4b}{d^3}+\frac{ax\left(\tan^2\left(\frac{dx}{2}+\frac{c}{2}\right)\right)}{d}+\frac{b\,x^2\left(\tan^2\left(\frac{dx}{2}+\frac{c}{2}\right)\right)}{d}+\frac{2a\tan\left(\frac{dx}{2}+\frac{c}{2}\right)}{d^2}-\frac{ax}{d}-\frac{b\,x^2}{d}+\frac{4bx\tan\left(\frac{dx}{2}+\frac{c}{2}\right)}{d^2}}{1+\tan^2\left(\frac{dx}{2}+\frac{c}{2}\right)}$ |
| derivativedivides | $\frac{ac\cos(dx+c)+a(\sin(dx+c)-\cos(dx+c)(dx+c))-\frac{b\,c^2\cos(dx+c)}{d}-\frac{2bc(\sin(dx+c)-\cos(dx+c)(dx+c))}{d}+\frac{b\left(-(dx+c)^2\cos(dx+c)+\cdots\right.}{\cdots}}{d^2}$ |
| default | $\frac{ac\cos(dx+c)+a(\sin(dx+c)-\cos(dx+c)(dx+c))-\frac{b\,c^2\cos(dx+c)}{d}-\frac{2bc(\sin(dx+c)-\cos(dx+c)(dx+c))}{d}+\frac{b\left(-(dx+c)^2\cos(dx+c)+\cdots\right.}{\cdots}}{d^2}$ |
| meijerg | $\frac{4b\sqrt{\pi}\,\sin(c)\left(\frac{x\left(d^2\right)^{\frac{3}{2}}\cos(dx)}{2\sqrt{\pi}\,d^2}-\frac{\left(d^2\right)^{\frac{3}{2}}\left(-\frac{3d^2x^2}{2}+3\right)\sin(dx)}{6\sqrt{\pi}\,d^3}\right)}{d^2\sqrt{d^2}}+\frac{4b\sqrt{\pi}\,\cos(c)\left(-\frac{1}{2\sqrt{\pi}}+\frac{\left(-\frac{d^2x^2}{2}+1\right)\cos(dx)}{2\sqrt{\pi}}+\frac{dx\sin(dx)}{2\sqrt{\pi}}\cdots\right.}{d^3}\cdots$ |

input
```
int(x*(b*x+a)*sin(d*x+c),x,method=_RETURNVERBOSE)
```

output
```
-(b*d^2*x^2+a*d^2*x-2*b)/d^3*cos(d*x+c)+1/d^2*(2*b*x+a)*sin(d*x+c)
```

### 3.3.5 Fricas [A] (verification not implemented)

Time = 0.27 (sec) , antiderivative size = 48, normalized size of antiderivative = 0.74

$$\int x(a+bx)\sin(c+dx)\,dx=-\frac{(bd^2x^2+ad^2x-2\,b)\cos(dx+c)-(2\,bdx+ad)\sin(dx+c)}{d^3}$$

input
```
integrate(x*(b*x+a)*sin(d*x+c),x, algorithm="fricas")
```

output
```
-((b*d^2*x^2 + a*d^2*x - 2*b)*cos(d*x + c) - (2*b*d*x + a*d)*sin(d*x + c))
/d^3
```

### 3.3.6 Sympy [A] (verification not implemented)

Time = 0.19 (sec) , antiderivative size = 82, normalized size of antiderivative = 1.26

$$\int x(a+bx)\sin(c+dx)\,dx = \begin{cases} -\frac{ax\cos(c+dx)}{d} + \frac{a\sin(c+dx)}{d^2} - \frac{bx^2\cos(c+dx)}{d} + \frac{2bx\sin(c+dx)}{d^2} + \frac{2b\cos(c+dx)}{d^3} & \text{for } d \neq 0 \\ \left(\frac{ax^2}{2} + \frac{bx^3}{3}\right)\sin(c) & \text{otherwise} \end{cases}$$

input
```
integrate(x*(b*x+a)*sin(d*x+c),x)
```

output
```
Piecewise((-a*x*cos(c + d*x)/d + a*sin(c + d*x)/d**2 - b*x**2*cos(c + d*x)
/d + 2*b*x*sin(c + d*x)/d**2 + 2*b*cos(c + d*x)/d**3, Ne(d, 0)), ((a*x**2/
2 + b*x**3/3)*sin(c), True))
```

### 3.3.7 Maxima [A] (verification not implemented)

Time = 0.19 (sec) , antiderivative size = 117, normalized size of antiderivative = 1.80

$$\int x(a+bx)\sin(c+dx)\,dx = \frac{ac\cos(dx+c) - \frac{bc^2\cos(dx+c)}{d} - ((dx+c)\cos(dx+c) - \sin(dx+c))a + \frac{2((dx+c)\cos(dx+c)-\sin(dx+c))bc}{d} - \frac{(((d}{}}{d^2}$$

input
```
integrate(x*(b*x+a)*sin(d*x+c),x, algorithm="maxima")
```

output
```
(a*c*cos(d*x + c) - b*c^2*cos(d*x + c)/d - ((d*x + c)*cos(d*x + c) - sin(d
*x + c))*a + 2*((d*x + c)*cos(d*x + c) - sin(d*x + c))*b*c/d - (((d*x + c)
^2 - 2)*cos(d*x + c) - 2*(d*x + c)*sin(d*x + c))*b/d)/d^2
```

### 3.3.8 Giac [A] (verification not implemented)

Time = 0.29 (sec) , antiderivative size = 49, normalized size of antiderivative = 0.75

$$\int x(a+bx)\sin(c+dx)\,dx = -\frac{(bd^2x^2+ad^2x-2\,b)\cos(dx+c)}{d^3} + \frac{(2\,bdx+ad)\sin(dx+c)}{d^3}$$

input
```
integrate(x*(b*x+a)*sin(d*x+c),x, algorithm="giac")
```

output
```
-(b*d^2*x^2 + a*d^2*x - 2*b)*cos(d*x + c)/d^3 + (2*b*d*x + a*d)*sin(d*x +
c)/d^3
```

### 3.3.9 Mupad [B] (verification not implemented)

Time = 6.08 (sec) , antiderivative size = 62, normalized size of antiderivative = 0.95

$$\int x(a+bx)\sin(c+dx)\,dx = \frac{a\,\sin(c+d\,x)+2\,b\,x\,\sin(c+d\,x)}{d^2} - \frac{a\,x\,\cos(c+d\,x)+b\,x^2\,\cos(c+d\,x)}{d} + \frac{2\,b\,\cos(c+d\,x)}{d^3}$$

input
```
int(x*sin(c + d*x)*(a + b*x),x)
```

output
```
(a*sin(c + d*x) + 2*b*x*sin(c + d*x))/d^2 - (a*x*cos(c + d*x) + b*x^2*cos(
c + d*x))/d + (2*b*cos(c + d*x))/d^3
```

# 3.4 $\int (a+bx)\sin(c+dx)\,dx$



## 3.4.1 Optimal result

Integrand size = 12, antiderivative size = 28

$$\int (a+bx)\sin(c+dx)\,dx = -\frac{(a+bx)\cos(c+dx)}{d}+\frac{b\sin(c+dx)}{d^2}$$

output
```
-(b*x+a)*cos(d*x+c)/d+b*sin(d*x+c)/d^2
```

## 3.4.2 Mathematica [A] (verified)

Time = 0.09 (sec) , antiderivative size = 27, normalized size of antiderivative = 0.96

$$\int (a+bx)\sin(c+dx)\,dx = \frac{-d(a+bx)\cos(c+dx)+b\sin(c+dx)}{d^2}$$

input
```
Integrate[(a + b*x)*Sin[c + d*x],x]
```

output
```
(-(d*(a + b*x)*Cos[c + d*x]) + b*Sin[c + d*x])/d^2
```

### 3.4.3 Rubi [A] (verified)

Time = 0.22 (sec) , antiderivative size = 28, normalized size of antiderivative = 1.00, number of steps used = 4, number of rules used = 4, $\frac{\text{number of rules}}{\text{integrand size}}$ = 0.333, Rules used = {3042, 3777, 3042, 3117}

Below are the steps used by Rubi to obtain the solution. The rule number used for the transformation is given above next to the arrow. The rules definitions used are listed below.

$$\int (a+bx)\sin(c+dx)\,dx$$

$$\Big\downarrow \ 3042$$

$$\int (a+bx)\sin(c+dx)dx$$

$$\Big\downarrow \ 3777$$

$$\frac{b\int \cos(c+dx)dx}{d}-\frac{(a+bx)\cos(c+dx)}{d}$$

$$\Big\downarrow \ 3042$$

$$\frac{b\int \sin\left(c+dx+\frac{\pi}{2}\right)dx}{d}-\frac{(a+bx)\cos(c+dx)}{d}$$

$$\Big\downarrow \ 3117$$

$$\frac{b\sin(c+dx)}{d^2}-\frac{(a+bx)\cos(c+dx)}{d}$$

input
```
Int[(a + b*x)*Sin[c + d*x],x]
```

output
```
-(((a + b*x)*Cos[c + d*x])/d) + (b*Sin[c + d*x])/d^2
```

#### 3.4.3.1 Defintions of rubi rules used

rule 3042
```
Int[u_, x_Symbol] :> Int[DeactivateTrig[u, x], x] /; FunctionOfTrigOfLinear
Q[u, x]
```

rule 3117
```
Int[sin[Pi/2 + (c_.) + (d_.)*(x_)], x_Symbol] :> Simp[Sin[c + d*x]/d, x] /;
 FreeQ[{c, d}, x]
```

rule 3777
```
Int[((c_.) + (d_.)*(x_))^(m_.)*sin[(e_.) + (f_.)*(x_)], x_Symbol] :> Simp[(
-(c + d*x)^m)*(Cos[e + f*x]/f), x] + Simp[d*(m/f)   Int[(c + d*x)^(m - 1)*C
os[e + f*x], x], x] /; FreeQ[{c, d, e, f}, x] && GtQ[m, 0]
```

### 3.4.4 Maple [A] (verified)

Time = 0.11 (sec) , antiderivative size = 29, normalized size of antiderivative = 1.04

| method | result |
|---|---|
| risch | $-\frac{(bx+a)\cos(dx+c)}{d}+\frac{b\sin(dx+c)}{d^2}$ |
| parallelrisch | $\frac{-(bx+a)d\cos(dx+c)+da+b\sin(dx+c)}{d^2}$ |
| parts | $-\frac{bx\cos(dx+c)}{d}-\frac{a\cos(dx+c)}{d}+\frac{b\sin(dx+c)}{d^2}$ |
| derivativedivides | $\frac{-a\cos(dx+c)+\frac{bc\cos(dx+c)}{d}+\frac{b(\sin(dx+c)-\cos(dx+c)(dx+c))}{d}}{d}$ |
| default | $\frac{-a\cos(dx+c)+\frac{bc\cos(dx+c)}{d}+\frac{b(\sin(dx+c)-\cos(dx+c)(dx+c))}{d}}{d}$ |
| norman | $\frac{\frac{2a\left(\tan^2\left(\frac{dx}{2}+\frac{c}{2}\right)\right)}{d}+\frac{bx\left(\tan^2\left(\frac{dx}{2}+\frac{c}{2}\right)\right)}{d}+\frac{2b\tan\left(\frac{dx}{2}+\frac{c}{2}\right)}{d^2}-\frac{bx}{d}}{1+\tan^2\left(\frac{dx}{2}+\frac{c}{2}\right)}$ |
| meijerg | $\frac{2b\sqrt{\pi}\,\sin(c)\left(-\frac{1}{2\sqrt{\pi}}+\frac{\cos(dx)}{2\sqrt{\pi}}+\frac{dx\sin(dx)}{2\sqrt{\pi}}\right)}{d^2}+\frac{2b\sqrt{\pi}\,\cos(c)\left(-\frac{dx\cos(dx)}{2\sqrt{\pi}}+\frac{\sin(dx)}{2\sqrt{\pi}}\right)}{d^2}+\frac{a\sin(c)\sin(dx)}{d}+\frac{a\sqrt{\pi}\,\cos(c)\left(\right.}{}$ |

input
```
int((b*x+a)*sin(d*x+c),x,method=_RETURNVERBOSE)
```

output
```
-(b*x+a)*cos(d*x+c)/d+b*sin(d*x+c)/d^2
```

### 3.4.5 Fricas [A] (verification not implemented)

Time = 0.26 (sec) , antiderivative size = 30, normalized size of antiderivative = 1.07

$$\int (a+bx)\sin(c+dx)\,dx = -\frac{(bdx+ad)\cos(dx+c)-b\sin(dx+c)}{d^2}$$

input
```
integrate((b*x+a)*sin(d*x+c),x, algorithm="fricas")
```

output
```
-((b*d*x + a*d)*cos(d*x + c) - b*sin(d*x + c))/d^2
```

### 3.4.6 Sympy [A] (verification not implemented)

Time = 0.15 (sec) , antiderivative size = 46, normalized size of antiderivative = 1.64

$$\int (a+bx)\sin(c+dx)\,dx = \begin{cases} -\frac{a\cos{(c+dx)}}{d} - \frac{bx\cos{(c+dx)}}{d} + \frac{b\sin{(c+dx)}}{d^2} & \text{for } d\neq 0 \\ \left(ax+\frac{bx^2}{2}\right)\sin{(c)} & \text{otherwise} \end{cases}$$

input
```
integrate((b*x+a)*sin(d*x+c),x)
```

output
```
Piecewise((-a*cos(c + d*x)/d - b*x*cos(c + d*x)/d + b*sin(c + d*x)/d**2, N
e(d, 0)), ((a*x + b*x**2/2)*sin(c), True))
```

### 3.4.7 Maxima [A] (verification not implemented)

Time = 0.19 (sec) , antiderivative size = 53, normalized size of antiderivative = 1.89

$$\int (a+bx)\sin(c+dx)\,dx = -\frac{a\cos{(dx+c)} - \frac{bc\cos(dx+c)}{d} + \frac{((dx+c)\cos(dx+c)-\sin(dx+c))b}{d}}{d}$$

input
```
integrate((b*x+a)*sin(d*x+c),x, algorithm="maxima")
```

output
```
-(a*cos(d*x + c) - b*c*cos(d*x + c)/d + ((d*x + c)*cos(d*x + c) - sin(d*x
+ c))*b/d)/d
```

### 3.4.8 Giac [A] (verification not implemented)

Time = 0.29 (sec) , antiderivative size = 31, normalized size of antiderivative = 1.11

$$\int (a+bx)\sin(c+dx)\,dx = -\frac{(bdx+ad)\cos{(dx+c)}}{d^2} + \frac{b\sin{(dx+c)}}{d^2}$$

input
```
integrate((b*x+a)*sin(d*x+c),x, algorithm="giac")
```

output
```
-(b*d*x + a*d)*cos(d*x + c)/d^2 + b*sin(d*x + c)/d^2
```

### 3.4.9 Mupad [B] (verification not implemented)

Time = 0.09 (sec) , antiderivative size = 35, normalized size of antiderivative = 1.25

$$\int (a+bx)\sin(c+dx)\,dx=\frac{b\sin(c+dx)}{d^2}-\frac{a\cos(c+dx)+bx\cos(c+dx)}{d}$$

input
```
int(sin(c + d*x)*(a + b*x),x)
```

output
```
(b*sin(c + d*x))/d^2 - (a*cos(c + d*x) + b*x*cos(c + d*x))/d
```

# 3.5 $\int \frac{(a+bx)\sin(c+dx)}{x}\,dx$



## 3.5.1 Optimal result

Integrand size = 15, antiderivative size = 29

$$\int \frac{(a+bx)\sin(c+dx)}{x}\,dx = -\frac{b\cos(c+dx)}{d} + a\,\text{CosIntegral}(dx)\sin(c) + a\cos(c)\text{Si}(dx)$$

output
```
-b*cos(d*x+c)/d+a*cos(c)*Si(d*x)+a*Ci(d*x)*sin(c)
```

## 3.5.2 Mathematica [A] (verified)

Time = 0.07 (sec) , antiderivative size = 40, normalized size of antiderivative = 1.38

$$\int \frac{(a+bx)\sin(c+dx)}{x}\,dx = -\frac{b\cos(c)\cos(dx)}{d} + a\,\text{CosIntegral}(dx)\sin(c) + \frac{b\sin(c)\sin(dx)}{d} + a\cos(c)\text{Si}(dx)$$

input
```
Integrate[((a + b*x)*Sin[c + d*x])/x,x]
```

output
```
-((b*Cos[c]*Cos[d*x])/d) + a*CosIntegral[d*x]*Sin[c] + (b*Sin[c]*Sin[d*x])
/d + a*Cos[c]*SinIntegral[d*x]
```

### 3.5.3 Rubi [A] (verified)

Time = 0.30 (sec) , antiderivative size = 29, normalized size of antiderivative = 1.00, number of steps used = 2, number of rules used = 2, $\frac{\text{number of rules}}{\text{integrand size}} = 0.133$, Rules used = {7293, 2009}

Below are the steps used by Rubi to obtain the solution. The rule number used for the transformation is given above next to the arrow. The rules definitions used are listed below.

$$\int \frac{(a+bx)\sin(c+dx)}{x}\,dx$$

$$\Big\downarrow \; 7293$$

$$\int \left(\frac{a\sin(c+dx)}{x}+b\sin(c+dx)\right)dx$$

$$\Big\downarrow \; 2009$$

$$a\sin(c)\,\text{CosIntegral}(dx)+a\cos(c)\text{Si}(dx)-\frac{b\cos(c+dx)}{d}$$

input
```
Int[((a + b*x)*Sin[c + d*x])/x,x]
```

output
```
-((b*Cos[c + d*x])/d) + a*CosIntegral[d*x]*Sin[c] + a*Cos[c]*SinIntegral[d
*x]
```

#### 3.5.3.1 Defintions of rubi rules used

rule 2009
```
Int[u_, x_Symbol] :> Simp[IntSum[u, x], x] /; SumQ[u]
```

rule 7293
```
Int[u_, x_Symbol] :> With[{v = ExpandIntegrand[u, x]}, Int[v, x] /; SumQ[v]
]
```

### 3.5.4 Maple [A] (verified)

Time = 0.14 (sec) , antiderivative size = 31, normalized size of antiderivative = 1.07

| method | result |
|---|---|
| derivativedivides | $a(\operatorname{Si}(dx)\cos(c)+\operatorname{Ci}(dx)\sin(c))-\frac{b\cos(dx+c)}{d}$ |
| default | $a(\operatorname{Si}(dx)\cos(c)+\operatorname{Ci}(dx)\sin(c))-\frac{b\cos(dx+c)}{d}$ |
| risch | $\frac{ia\,\mathrm{e}^{ic}\operatorname{Ei}_1(-idx)}{2}-\frac{\pi\ \operatorname{csgn}(dx)\mathrm{e}^{-ic}a}{2}+\operatorname{Si}(dx)\,\mathrm{e}^{-ic}a-\frac{i\mathrm{e}^{-ic}\operatorname{Ei}_1(-idx)a}{2}-\frac{b\cos(dx+c)}{d}$ |
| meijerg | $\frac{b\sin(c)\sin(dx)}{d}+\frac{b\sqrt{\pi}\ \cos(c)\left(\frac{1}{\sqrt{\pi}}-\frac{\cos(dx)}{\sqrt{\pi}}\right)}{d}+\frac{a\sqrt{\pi}\ \sin(c)\left(\frac{2\gamma+2\ln(x)+\ln\left(d^2\right)}{\sqrt{\pi}}-\frac{2\gamma}{\sqrt{\pi}}-\frac{2\ln(2)}{\sqrt{\pi}}-\frac{2\ln\left(\frac{dx}{2}\right)}{\sqrt{\pi}}+\frac{2\ \operatorname{Ci}(dx)}{\sqrt{\pi}}\right)}{2}$ |

input
```
int((b*x+a)*sin(d*x+c)/x,x,method=_RETURNVERBOSE)
```

output
```
a*(Si(d*x)*cos(c)+Ci(d*x)*sin(c))-b*cos(d*x+c)/d
```

### 3.5.5 Fricas [A] (verification not implemented)

Time = 0.27 (sec) , antiderivative size = 32, normalized size of antiderivative = 1.10

$$\int \frac{(a+bx)\sin(c+dx)}{x}\,dx=\frac{ad\operatorname{Ci}(dx)\sin(c)+ad\cos(c)\operatorname{Si}(dx)-b\cos(dx+c)}{d}$$

input
```
integrate((b*x+a)*sin(d*x+c)/x,x, algorithm="fricas")
```

output
```
(a*d*cos_integral(d*x)*sin(c) + a*d*cos(c)*sin_integral(d*x) - b*cos(d*x +
 c))/d
```

### 3.5.6 Sympy [A] (verification not implemented)

Time = 2.61 (sec) , antiderivative size = 37, normalized size of antiderivative = 1.28

$$\int \frac{(a+bx)\sin(c+dx)}{x}\,dx=-a(-\sin(c)\operatorname{Ci}(dx)-\cos(c)\operatorname{Si}(dx))-b\left(\begin{cases}-x\sin(c) & \text{for } d=0\\ \frac{\cos(c+dx)}{d} & \text{otherwise}\end{cases}\right)$$

input
```
integrate((b*x+a)*sin(d*x+c)/x,x)
```

output
```
-a*(-sin(c)*Ci(d*x) - cos(c)*Si(d*x)) - b*Piecewise((-x*sin(c), Eq(d, 0)),
 (cos(c + d*x)/d, True))
```

### 3.5.7 Maxima [C] (verification not implemented)

Result contains complex when optimal does not.

Time = 0.26 (sec) , antiderivative size = 522, normalized size of antiderivative = 18.00

$$\int \frac{(a+bx)\sin(c+dx)}{x}\,dx$$
$$= -\frac{1}{2}\left((i\,E_1(i\,dx) - i\,E_1(-i\,dx))\cos(c) + (E_1(i\,dx) + E_1(-i\,dx))\sin(c)\right)a$$
$$+ \frac{((i\,E_1(i\,dx) - i\,E_1(-i\,dx))\cos(c) + (E_1(i\,dx) + E_1(-i\,dx))\sin(c))bc}{2\,d}$$
$$- \frac{(2\,(dx+c)\left(\cos(c)^2 + \sin(c)^2\right)\cos(dx+c)^3 + 2\,(dx+c)\left(\cos(c)^2 + \sin(c)^2\right)\cos(dx+c) - (c(E_2(i\,dx)}{}$$

input
```
integrate((b*x+a)*sin(d*x+c)/x,x, algorithm="maxima")
```

output
```
-1/2*((I*exp_integral_e(1, I*d*x) - I*exp_integral_e(1, -I*d*x))*cos(c) +
(exp_integral_e(1, I*d*x) + exp_integral_e(1, -I*d*x))*sin(c))*a + 1/2*((I
*exp_integral_e(1, I*d*x) - I*exp_integral_e(1, -I*d*x))*cos(c) + (exp_int
egral_e(1, I*d*x) + exp_integral_e(1, -I*d*x))*sin(c))*b*c/d - 1/4*(2*(d*x
 + c)*(cos(c)^2 + sin(c)^2)*cos(d*x + c)^3 + 2*(d*x + c)*(cos(c)^2 + sin(c
)^2)*cos(d*x + c) - (c*(exp_integral_e(2, I*d*x) + exp_integral_e(2, -I*d*
x))*cos(c)^3 + c*(exp_integral_e(2, I*d*x) + exp_integral_e(2, -I*d*x))*co
s(c)*sin(c)^2 - c*(I*exp_integral_e(2, I*d*x) - I*exp_integral_e(2, -I*d*x
))*sin(c)^3 + c*(exp_integral_e(2, I*d*x) + exp_integral_e(2, -I*d*x))*cos
(c) - (c*(I*exp_integral_e(2, I*d*x) - I*exp_integral_e(2, -I*d*x))*cos(c)
^2 + c*(I*exp_integral_e(2, I*d*x) - I*exp_integral_e(2, -I*d*x)))*sin(c))
*cos(d*x + c)^2 - (c*(exp_integral_e(2, I*d*x) + exp_integral_e(2, -I*d*x)
)*cos(c)^3 + c*(exp_integral_e(2, I*d*x) + exp_integral_e(2, -I*d*x))*cos(
c)*sin(c)^2 - c*(I*exp_integral_e(2, I*d*x) - I*exp_integral_e(2, -I*d*x))
*sin(c)^3 - 2*(d*x + c)*(cos(c)^2 + sin(c)^2)*cos(d*x + c) + c*(exp_integr
al_e(2, I*d*x) + exp_integral_e(2, -I*d*x))*cos(c) - (c*(I*exp_integral_e(
2, I*d*x) - I*exp_integral_e(2, -I*d*x))*cos(c)^2 + c*(I*exp_integral_e(2,
 I*d*x) - I*exp_integral_e(2, -I*d*x)))*sin(c))*sin(d*x + c)^2)*b/(((d*x +
 c)*(cos(c)^2 + sin(c)^2)*d - (c*cos(c)^2 + c*sin(c)^2)*d)*cos(d*x + c)^2
+ ((d*x + c)*(cos(c)^2 + sin(c)^2)*d - (c*cos(c)^2 + c*sin(c)^2)*d)*sin...
```

### 3.5.8 Giac [C] (verification not implemented)

Result contains higher order function than in optimal. Order 9 vs. order 4.

Time = 0.29 (sec) , antiderivative size = 339, normalized size of antiderivative = 11.69

$$\int \frac{(a+bx)\sin(c+dx)}{x}\,dx =$$

$$-\frac{ad\Im(\mathrm{Ci}\,(dx))\tan\left(\frac{1}{2}\,dx\right)^2\tan\left(\frac{1}{2}\,c\right)^2 - ad\Im(\mathrm{Ci}\,(-dx))\tan\left(\frac{1}{2}\,dx\right)^2\tan\left(\frac{1}{2}\,c\right)^2 + 2\,ad\,\mathrm{Si}\,(dx)\tan\left(\frac{1}{2}\,dx\right)^2\mathrm{ta}}{}$$

input
```
integrate((b*x+a)*sin(d*x+c)/x,x, algorithm="giac")
```

output
```
-1/2*(a*d*imag_part(cos_integral(d*x))*tan(1/2*d*x)^2*tan(1/2*c)^2 - a*d*i
mag_part(cos_integral(-d*x))*tan(1/2*d*x)^2*tan(1/2*c)^2 + 2*a*d*sin_integ
ral(d*x)*tan(1/2*d*x)^2*tan(1/2*c)^2 - 2*a*d*real_part(cos_integral(d*x))*
tan(1/2*d*x)^2*tan(1/2*c) - 2*a*d*real_part(cos_integral(-d*x))*tan(1/2*d*
x)^2*tan(1/2*c) - a*d*imag_part(cos_integral(d*x))*tan(1/2*d*x)^2 + a*d*im
ag_part(cos_integral(-d*x))*tan(1/2*d*x)^2 - 2*a*d*sin_integral(d*x)*tan(1
/2*d*x)^2 + a*d*imag_part(cos_integral(d*x))*tan(1/2*c)^2 - a*d*imag_part(
cos_integral(-d*x))*tan(1/2*c)^2 + 2*a*d*sin_integral(d*x)*tan(1/2*c)^2 +
2*b*tan(1/2*d*x)^2*tan(1/2*c)^2 - 2*a*d*real_part(cos_integral(d*x))*tan(1
/2*c) - 2*a*d*real_part(cos_integral(-d*x))*tan(1/2*c) - a*d*imag_part(cos
_integral(d*x)) + a*d*imag_part(cos_integral(-d*x)) - 2*a*d*sin_integral(d
*x) - 2*b*tan(1/2*d*x)^2 - 8*b*tan(1/2*d*x)*tan(1/2*c) - 2*b*tan(1/2*c)^2
+ 2*b)/(d*tan(1/2*d*x)^2*tan(1/2*c)^2 + d*tan(1/2*d*x)^2 + d*tan(1/2*c)^2
+ d)
```

### 3.5.9 Mupad [F(-1)]

Timed out.

$$\int \frac{(a+bx)\sin(c+dx)}{x}\,dx = a\,\mathrm{cosint}(d\,x)\,\sin\left(c\right) + a\,\mathrm{sinint}(d\,x)\,\cos\left(c\right) - \frac{b\,\cos\left(c+d\,x\right)}{d}$$

input
```
int((sin(c + d*x)*(a + b*x))/x,x)
```

output
```
a*cosint(d*x)*sin(c) + a*sinint(d*x)*cos(c) - (b*cos(c + d*x))/d
```

# 3.6 $\int \frac{(a+bx)\sin(c+dx)}{x^2}\,dx$



## 3.6.1 Optimal result

Integrand size = 15, antiderivative size = 48

$$\int \frac{(a+bx)\sin(c+dx)}{x^2}\,dx = ad\cos(c)\operatorname{CosIntegral}(dx) + b\operatorname{CosIntegral}(dx)\sin(c) - \frac{a\sin(c+dx)}{x} + b\cos(c)\operatorname{Si}(dx) - ad\sin(c)\operatorname{Si}(dx)$$

output
```
a*d*Ci(d*x)*cos(c)+b*cos(c)*Si(d*x)+b*Ci(d*x)*sin(c)-a*d*Si(d*x)*sin(c)-a*
sin(d*x+c)/x
```

## 3.6.2 Mathematica [A] (verified)

Time = 0.15 (sec) , antiderivative size = 60, normalized size of antiderivative = 1.25

$$\int \frac{(a+bx)\sin(c+dx)}{x^2}\,dx = -\frac{a\cos(dx)\sin(c)}{x} + b\operatorname{CosIntegral}(dx)\sin(c) - \frac{a\cos(c)\sin(dx)}{x} + b\cos(c)\operatorname{Si}(dx) + ad(\cos(c)\operatorname{CosIntegral}(dx) - \sin(c)\operatorname{Si}(dx))$$

input
```
Integrate[((a + b*x)*Sin[c + d*x])/x^2,x]
```

output
```
-((a*Cos[d*x]*Sin[c])/x) + b*CosIntegral[d*x]*Sin[c] - (a*Cos[c]*Sin[d*x])
/x + b*Cos[c]*SinIntegral[d*x] + a*d*(Cos[c]*CosIntegral[d*x] - Sin[c]*Sin
Integral[d*x])
```

### 3.6.3 Rubi [A] (verified)

Time = 0.37 (sec) , antiderivative size = 48, normalized size of antiderivative = 1.00, number of steps used = 2, number of rules used = 2, $\frac{\text{number of rules}}{\text{integrand size}}$ = 0.133, Rules used = {7293, 2009}

Below are the steps used by Rubi to obtain the solution. The rule number used for the transformation is given above next to the arrow. The rules definitions used are listed below.

$$\int \frac{(a+bx)\sin(c+dx)}{x^2}\,dx$$

$$\Big\downarrow \; 7293$$

$$\int \left(\frac{a\sin(c+dx)}{x^2}+\frac{b\sin(c+dx)}{x}\right)dx$$

$$\Big\downarrow \; 2009$$

$$ad\cos(c)\,\text{CosIntegral}(dx)-ad\sin(c)\text{Si}(dx)-\frac{a\sin(c+dx)}{x}+b\sin(c)\,\text{CosIntegral}(dx)+b\cos(c)\text{Si}(dx)$$

input
```
Int[((a + b*x)*Sin[c + d*x])/x^2,x]
```

output
```
a*d*Cos[c]*CosIntegral[d*x] + b*CosIntegral[d*x]*Sin[c] - (a*Sin[c + d*x])
/x + b*Cos[c]*SinIntegral[d*x] - a*d*Sin[c]*SinIntegral[d*x]
```

#### 3.6.3.1 Defintions of rubi rules used

rule 2009
```
Int[u_, x_Symbol] :> Simp[IntSum[u, x], x] /; SumQ[u]
```

rule 7293
```
Int[u_, x_Symbol] :> With[{v = ExpandIntegrand[u, x]}, Int[v, x] /; SumQ[v]
]
```

### 3.6.4 Maple [A] (verified)

Time = 0.15 (sec) , antiderivative size = 56, normalized size of antiderivative = 1.17

| method | result |
|---|---|
| derivativedivides | $d\left(a\left(-\frac{\sin(dx+c)}{dx}-\operatorname{Si}(dx)\sin(c)+\operatorname{Ci}(dx)\cos(c)\right)+\frac{b(\operatorname{Si}(dx)\cos(c)+\operatorname{Ci}(dx)\sin(c))}{d}\right)$ |
| default | $d\left(a\left(-\frac{\sin(dx+c)}{dx}-\operatorname{Si}(dx)\sin(c)+\operatorname{Ci}(dx)\cos(c)\right)+\frac{b(\operatorname{Si}(dx)\cos(c)+\operatorname{Ci}(dx)\sin(c))}{d}\right)$ |
| risch | $\frac{i e^{ic}\operatorname{Ei}_1(-idx)b}{2}-\frac{a\,e^{ic}\operatorname{Ei}_1(-idx)d}{2}-\frac{i e^{-ic}\operatorname{Ei}_1(idx)b}{2}-\frac{a\,e^{-ic}\operatorname{Ei}_1(idx)d}{2}-\frac{a\sin(dx+c)}{x}$ |
| meijerg | $\frac{b\sqrt{\pi}\sin(c)\left(\frac{2\gamma+2\ln(x)+\ln(d^2)}{\sqrt{\pi}}-\frac{2\gamma}{\sqrt{\pi}}-\frac{2\ln(2)}{\sqrt{\pi}}-\frac{2\ln\left(\frac{dx}{2}\right)}{\sqrt{\pi}}+\frac{2\operatorname{Ci}(dx)}{\sqrt{\pi}}\right)}{2}+b\cos(c)\operatorname{Si}(dx)+\frac{a\sqrt{\pi}\sin(c)d^2\left(-\frac{4d^2 c}{x(c}\right.}{4}$ |

input
```
int((b*x+a)*sin(d*x+c)/x^2,x,method=_RETURNVERBOSE)
```

output
```
d*(a*(-sin(d*x+c)/d/x-Si(d*x)*sin(c)+Ci(d*x)*cos(c))+1/d*b*(Si(d*x)*cos(c)
+Ci(d*x)*sin(c)))
```

### 3.6.5 Fricas [A] (verification not implemented)

Time = 0.28 (sec) , antiderivative size = 54, normalized size of antiderivative = 1.12

$$\int \frac{(a+bx)\sin(c+dx)}{x^2}\,dx$$
$$=\frac{(adx\operatorname{Ci}(dx)+bx\operatorname{Si}(dx))\cos(c)-a\sin(dx+c)-(adx\operatorname{Si}(dx)-bx\operatorname{Ci}(dx))\sin(c)}{x}$$

input
```
integrate((b*x+a)*sin(d*x+c)/x^2,x, algorithm="fricas")
```

output
```
((a*d*x*cos_integral(d*x) + b*x*sin_integral(d*x))*cos(c) - a*sin(d*x + c)
 - (a*d*x*sin_integral(d*x) - b*x*cos_integral(d*x))*sin(c))/x
```

### 3.6.6 Sympy [F]

$$\int \frac{(a+bx)\sin(c+dx)}{x^2}\,dx = \int \frac{(a+bx)\sin{(c+dx)}}{x^2}\,dx$$

input
```
integrate((b*x+a)*sin(d*x+c)/x**2,x)
```

output
```
Integral((a + b*x)*sin(c + d*x)/x**2, x)
```

### 3.6.7 Maxima [C] (verification not implemented)

Result contains complex when optimal does not.

Time = 0.40 (sec) , antiderivative size = 108, normalized size of antiderivative = 2.25

$$\int \frac{(a+bx)\sin(c+dx)}{x^2}\,dx$$
$$= \frac{((a(\Gamma(-1,i\,dx)+\Gamma(-1,-i\,dx))\cos{(c)} - a(i\,\Gamma(-1,i\,dx)-i\,\Gamma(-1,-i\,dx))\sin{(c)})d^2 - (b(-i\,\Gamma(-1,i\,dx)}{2\,dx}$$

input
```
integrate((b*x+a)*sin(d*x+c)/x^2,x, algorithm="maxima")
```

output
```
1/2*(((a*(gamma(-1, I*d*x) + gamma(-1, -I*d*x))*cos(c) - a*(I*gamma(-1, I*
d*x) - I*gamma(-1, -I*d*x))*sin(c))*d^2 - (b*(-I*gamma(-1, I*d*x) + I*gamm
a(-1, -I*d*x))*cos(c) - b*(gamma(-1, I*d*x) + gamma(-1, -I*d*x))*sin(c))*d
)*x - 2*b*cos(d*x + c))/(d*x)
```

### 3.6.8 Giac [C] (verification not implemented)

Result contains higher order function than in optimal. Order 9 vs. order 4.

Time = 0.30 (sec) , antiderivative size = 569, normalized size of antiderivative = 11.85

$$\int \frac{(a+bx)\sin(c+dx)}{x^2}\,dx = \text{Too large to display}$$

input
```
integrate((b*x+a)*sin(d*x+c)/x^2,x, algorithm="giac")
```

output
```
-1/2*(a*d*x*real_part(cos_integral(d*x))*tan(1/2*d*x)^2*tan(1/2*c)^2 + a*d
*x*real_part(cos_integral(-d*x))*tan(1/2*d*x)^2*tan(1/2*c)^2 + 2*a*d*x*ima
g_part(cos_integral(d*x))*tan(1/2*d*x)^2*tan(1/2*c) - 2*a*d*x*imag_part(co
s_integral(-d*x))*tan(1/2*d*x)^2*tan(1/2*c) + 4*a*d*x*sin_integral(d*x)*ta
n(1/2*d*x)^2*tan(1/2*c) + b*x*imag_part(cos_integral(d*x))*tan(1/2*d*x)^2*
tan(1/2*c)^2 - b*x*imag_part(cos_integral(-d*x))*tan(1/2*d*x)^2*tan(1/2*c)
^2 + 2*b*x*sin_integral(d*x)*tan(1/2*d*x)^2*tan(1/2*c)^2 - a*d*x*real_part
(cos_integral(d*x))*tan(1/2*d*x)^2 - a*d*x*real_part(cos_integral(-d*x))*t
an(1/2*d*x)^2 - 2*b*x*real_part(cos_integral(d*x))*tan(1/2*d*x)^2*tan(1/2*
c) - 2*b*x*real_part(cos_integral(-d*x))*tan(1/2*d*x)^2*tan(1/2*c) + a*d*x
*real_part(cos_integral(d*x))*tan(1/2*c)^2 + a*d*x*real_part(cos_integral(
-d*x))*tan(1/2*c)^2 - b*x*imag_part(cos_integral(d*x))*tan(1/2*d*x)^2 + b*
x*imag_part(cos_integral(-d*x))*tan(1/2*d*x)^2 - 2*b*x*sin_integral(d*x)*t
an(1/2*d*x)^2 + 2*a*d*x*imag_part(cos_integral(d*x))*tan(1/2*c) - 2*a*d*x*
imag_part(cos_integral(-d*x))*tan(1/2*c) + 4*a*d*x*sin_integral(d*x)*tan(1
/2*c) + b*x*imag_part(cos_integral(d*x))*tan(1/2*c)^2 - b*x*imag_part(cos_
integral(-d*x))*tan(1/2*c)^2 + 2*b*x*sin_integral(d*x)*tan(1/2*c)^2 - a*d*
x*real_part(cos_integral(d*x)) - a*d*x*real_part(cos_integral(-d*x)) - 2*b
*x*real_part(cos_integral(d*x))*tan(1/2*c) - 2*b*x*real_part(cos_integral(
-d*x))*tan(1/2*c) - 4*a*tan(1/2*d*x)^2*tan(1/2*c) - 4*a*tan(1/2*d*x)*ta...
```

### 3.6.9 Mupad [F(-1)]

Timed out.

$$\int \frac{(a+bx)\sin(c+dx)}{x^2}\,dx = \int \frac{\sin(c+d\,x)\,(a+b\,x)}{x^2}\,dx$$

input
```
int((sin(c + d*x)*(a + b*x))/x^2,x)
```

output
```
int((sin(c + d*x)*(a + b*x))/x^2, x)
```

## 3.7 $\int \frac{(a+bx)\sin(c+dx)}{x^3}\,dx$



### 3.7.1 Optimal result

Integrand size = 15, antiderivative size = 89

$$\int \frac{(a+bx)\sin(c+dx)}{x^3}\,dx = -\frac{ad\cos(c+dx)}{2x} + bd\cos(c)\operatorname{CosIntegral}(dx) - \frac{1}{2}ad^2\operatorname{CosIntegral}(dx)\sin(c) - \frac{a\sin(c+dx)}{2x^2} - \frac{b\sin(c+dx)}{x} - \frac{1}{2}ad^2\cos(c)\operatorname{Si}(dx) - bd\sin(c)\operatorname{Si}(dx)$$

output
```
b*d*Ci(d*x)*cos(c)-1/2*a*d*cos(d*x+c)/x-1/2*a*d^2*cos(c)*Si(d*x)-1/2*a*d^2
*Ci(d*x)*sin(c)-b*d*Si(d*x)*sin(c)-1/2*a*sin(d*x+c)/x^2-b*sin(d*x+c)/x
```

### 3.7.2 Mathematica [A] (verified)

Time = 0.24 (sec) , antiderivative size = 76, normalized size of antiderivative = 0.85

$$\int \frac{(a+bx)\sin(c+dx)}{x^3}\,dx = -\frac{adx\cos(c+dx) + dx^2\operatorname{CosIntegral}(dx)(-2b\cos(c) + ad\sin(c)) + a\sin(c+dx) + 2bx\sin(c+dx) + dx^2}{2x^2}$$

input
```
Integrate[((a + b*x)*Sin[c + d*x])/x^3,x]
```

output
```
-1/2*(a*d*x*Cos[c + d*x] + d*x^2*CosIntegral[d*x]*(-2*b*Cos[c] + a*d*Sin[c
]) + a*Sin[c + d*x] + 2*b*x*Sin[c + d*x] + d*x^2*(a*d*Cos[c] + 2*b*Sin[c])
*SinIntegral[d*x])/x^2
```

### 3.7.3 Rubi [A] (verified)

Time = 0.43 (sec) , antiderivative size = 89, normalized size of antiderivative = 1.00, number of steps used = 2, number of rules used = 2, $\frac{\text{number of rules}}{\text{integrand size}}$ = 0.133, Rules used = {7293, 2009}

Below are the steps used by Rubi to obtain the solution. The rule number used for the transformation is given above next to the arrow. The rules definitions used are listed below.

$$\int \frac{(a+bx)\sin(c+dx)}{x^3}\,dx$$

$$\Big\downarrow \text{7293}$$

$$\int \left(\frac{a\sin(c+dx)}{x^3}+\frac{b\sin(c+dx)}{x^2}\right)dx$$

$$\Big\downarrow \text{2009}$$

$$-\frac{1}{2}ad^2\sin(c)\,\text{CosIntegral}(dx)-\frac{1}{2}ad^2\cos(c)\text{Si}(dx)-\frac{a\sin(c+dx)}{2x^2}-\frac{ad\cos(c+dx)}{2x}+bd\cos(c)\,\text{CosIntegral}(dx)-bd\sin(c)\text{Si}(dx)-\frac{b\sin(c+dx)}{x}$$

input
```
Int[((a + b*x)*Sin[c + d*x])/x^3,x]
```

output
```
-1/2*(a*d*Cos[c + d*x])/x + b*d*Cos[c]*CosIntegral[d*x] - (a*d^2*CosIntegr
al[d*x]*Sin[c])/2 - (a*Sin[c + d*x])/(2*x^2) - (b*Sin[c + d*x])/x - (a*d^2
*Cos[c]*SinIntegral[d*x])/2 - b*d*Sin[c]*SinIntegral[d*x]
```

### 3.7.3.1 Defintions of rubi rules used

rule 2009
```
Int[u_, x_Symbol] :> Simp[IntSum[u, x], x] /; SumQ[u]
```

rule 7293
```
Int[u_, x_Symbol] :> With[{v = ExpandIntegrand[u, x]}, Int[v, x] /; SumQ[v]
]
```

## 3.7.4 Maple [A] (verified)

Time = 0.16 (sec) , antiderivative size = 88, normalized size of antiderivative = 0.99

| method | result |
|---|---|
| derivativedivides | $d^{2}\left(a\left(-\frac{\sin(dx+c)}{2d^{2}x^{2}}-\frac{\cos(dx+c)}{2dx}-\frac{\mathrm{Si}(dx)\cos(c)}{2}-\frac{\mathrm{Ci}(dx)\sin(c)}{2}\right)+\frac{b\left(-\frac{\sin(dx+c)}{dx}-\mathrm{Si}(dx)\sin(c)+\mathrm{Ci}(dx)\cos\right.}{d}\right.$ |
| default | $d^{2}\left(a\left(-\frac{\sin(dx+c)}{2d^{2}x^{2}}-\frac{\cos(dx+c)}{2dx}-\frac{\mathrm{Si}(dx)\cos(c)}{2}-\frac{\mathrm{Ci}(dx)\sin(c)}{2}\right)+\frac{b\left(-\frac{\sin(dx+c)}{dx}-\mathrm{Si}(dx)\sin(c)+\mathrm{Ci}(dx)\cos\right.}{d}\right.$ |
| risch | $-\frac{\mathrm{Ei}_1(-idx)\cos(c)bd}{2}-\frac{\cos(c)\,\mathrm{Ei}_1(idx)bd}{2}-\frac{i\,\mathrm{Ei}_1(-idx)\cos(c)a\,d^{2}}{4}+\frac{i\cos(c)\,\mathrm{Ei}_1(idx)a\,d^{2}}{4}-\frac{i\,\mathrm{Ei}_1(-idx)\sin(c)b}{2}$ |
| meijerg | $\frac{d^{2}b\sqrt{\pi}\sin(c)\left(-\frac{4d^{2}\cos\left(x\sqrt{d^{2}}\right)}{x\left(d^{2}\right)^{\frac{3}{2}}\sqrt{\pi}}-\frac{4\,\mathrm{Si}\left(x\sqrt{d^{2}}\right)}{\sqrt{\pi}}\right)}{4\sqrt{d^{2}}}+\frac{db\sqrt{\pi}\cos(c)\left(\frac{4\gamma-4+4\ln(x)+4\ln(d)}{\sqrt{\pi}}+\frac{4}{\sqrt{\pi}}-\frac{4\gamma}{\sqrt{\pi}}-\frac{4\ln(2)}{\sqrt{\pi}}-\frac{4\ln\left(\frac{dx}{2}\right)}{\sqrt{\pi}}-\right.}{4}$ |

input
```
int((b*x+a)*sin(d*x+c)/x^3,x,method=_RETURNVERBOSE)
```

output
```
d^2*(a*(-1/2*sin(d*x+c)/d^2/x^2-1/2*cos(d*x+c)/d/x-1/2*Si(d*x)*cos(c)-1/2*
Ci(d*x)*sin(c))+1/d*b*(-sin(d*x+c)/d/x-Si(d*x)*sin(c)+Ci(d*x)*cos(c)))
```

## 3.7.5 Fricas [A] (verification not implemented)

Time = 0.27 (sec) , antiderivative size = 83, normalized size of antiderivative = 0.93

$$\int \frac{(a+bx)\sin(c+dx)}{x^3}\,dx = -\frac{adx\cos(dx+c)+\left(ad^{2}x^{2}\,\mathrm{Si}(dx)-2\,bdx^{2}\,\mathrm{Ci}(dx)\right)\cos(c)+(2\,bx+a)\sin(dx+c)+\left(ad^{2}x^{2}\,\mathrm{Ci}(dx)+2\right.}{2\,x^{2}}$$

input
```
integrate((b*x+a)*sin(d*x+c)/x^3,x, algorithm="fricas")
```

output
```
-1/2*(a*d*x*cos(d*x + c) + (a*d^2*x^2*sin_integral(d*x) - 2*b*d*x^2*cos_in
tegral(d*x))*cos(c) + (2*b*x + a)*sin(d*x + c) + (a*d^2*x^2*cos_integral(d
*x) + 2*b*d*x^2*sin_integral(d*x))*sin(c))/x^2
```

### 3.7.6 Sympy [F]

$$\int \frac{(a+bx)\sin(c+dx)}{x^3}\,dx = \int \frac{(a+bx)\sin{(c+dx)}}{x^3}\,dx$$

input
```
integrate((b*x+a)*sin(d*x+c)/x**3,x)
```

output
```
Integral((a + b*x)*sin(c + d*x)/x**3, x)
```

### 3.7.7 Maxima [C] (verification not implemented)

Result contains complex when optimal does not.

Time = 0.44 (sec) , antiderivative size = 112, normalized size of antiderivative = 1.26

$$\int \frac{(a+bx)\sin(c+dx)}{x^3}\,dx = -\frac{((a(-i\,\Gamma(-2,i\,dx)+i\,\Gamma(-2,-i\,dx))\cos{(c)}-a(\Gamma(-2,i\,dx)+\Gamma(-2,-i\,dx))\sin{(c)})d^3+2\,(b(\Gamma(-2,i\,d}{2\,dx^2}$$

input
```
integrate((b*x+a)*sin(d*x+c)/x^3,x, algorithm="maxima")
```

output
```
-1/2*(((a*(-I*gamma(-2, I*d*x) + I*gamma(-2, -I*d*x))*cos(c) - a*(gamma(-2
, I*d*x) + gamma(-2, -I*d*x))*sin(c))*d^3 + 2*(b*(gamma(-2, I*d*x) + gamma
(-2, -I*d*x))*cos(c) - b*(I*gamma(-2, I*d*x) - I*gamma(-2, -I*d*x))*sin(c)
)*d^2)*x^2 + 2*b*cos(d*x + c))/(d*x^2)
```

### 3.7.8 Giac [C] (verification not implemented)

Result contains higher order function than in optimal. Order 9 vs. order 4.

Time = 0.30 (sec) , antiderivative size = 796, normalized size of antiderivative = 8.94

$$\int \frac{(a+bx)\sin(c+dx)}{x^3}\,dx = \text{Too large to display}$$

input
```
integrate((b*x+a)*sin(d*x+c)/x^3,x, algorithm="giac")
```

output
```
1/4*(a*d^2*x^2*imag_part(cos_integral(d*x))*tan(1/2*d*x)^2*tan(1/2*c)^2 -
a*d^2*x^2*imag_part(cos_integral(-d*x))*tan(1/2*d*x)^2*tan(1/2*c)^2 + 2*a*
d^2*x^2*sin_integral(d*x)*tan(1/2*d*x)^2*tan(1/2*c)^2 - 2*a*d^2*x^2*real_p
art(cos_integral(d*x))*tan(1/2*d*x)^2*tan(1/2*c) - 2*a*d^2*x^2*real_part(c
os_integral(-d*x))*tan(1/2*d*x)^2*tan(1/2*c) - 2*b*d*x^2*real_part(cos_int
egral(d*x))*tan(1/2*d*x)^2*tan(1/2*c)^2 - 2*b*d*x^2*real_part(cos_integral
(-d*x))*tan(1/2*d*x)^2*tan(1/2*c)^2 - a*d^2*x^2*imag_part(cos_integral(d*x
))*tan(1/2*d*x)^2 + a*d^2*x^2*imag_part(cos_integral(-d*x))*tan(1/2*d*x)^2
 - 2*a*d^2*x^2*sin_integral(d*x)*tan(1/2*d*x)^2 - 4*b*d*x^2*imag_part(cos_
integral(d*x))*tan(1/2*d*x)^2*tan(1/2*c) + 4*b*d*x^2*imag_part(cos_integra
l(-d*x))*tan(1/2*d*x)^2*tan(1/2*c) - 8*b*d*x^2*sin_integral(d*x)*tan(1/2*d
*x)^2*tan(1/2*c) + a*d^2*x^2*imag_part(cos_integral(d*x))*tan(1/2*c)^2 - a
*d^2*x^2*imag_part(cos_integral(-d*x))*tan(1/2*c)^2 + 2*a*d^2*x^2*sin_inte
gral(d*x)*tan(1/2*c)^2 + 2*b*d*x^2*real_part(cos_integral(d*x))*tan(1/2*d*
x)^2 + 2*b*d*x^2*real_part(cos_integral(-d*x))*tan(1/2*d*x)^2 - 2*a*d^2*x^
2*real_part(cos_integral(d*x))*tan(1/2*c) - 2*a*d^2*x^2*real_part(cos_inte
gral(-d*x))*tan(1/2*c) - 2*b*d*x^2*real_part(cos_integral(d*x))*tan(1/2*c)
^2 - 2*b*d*x^2*real_part(cos_integral(-d*x))*tan(1/2*c)^2 - 2*a*d*x*tan(1/
2*d*x)^2*tan(1/2*c)^2 - a*d^2*x^2*imag_part(cos_integral(d*x)) + a*d^2*x^2
*imag_part(cos_integral(-d*x)) - 2*a*d^2*x^2*sin_integral(d*x) - 4*b*d*...
```

### 3.7.9 Mupad [F(-1)]

Timed out.

$$\int \frac{(a+bx)\sin(c+dx)}{x^3}\,dx = \int \frac{\sin(c+d\,x)\,(a+b\,x)}{x^3}\,dx$$

input
```
int((sin(c + d*x)*(a + b*x))/x^3,x)
```

output
```
int((sin(c + d*x)*(a + b*x))/x^3, x)
```

# 3.8 $\int \frac{(a+bx)\sin(c+dx)}{x^4} dx$



## 3.8.1 Optimal result

Integrand size = 15, antiderivative size = 132

$$\int \frac{(a+bx)\sin(c+dx)}{x^4}\,dx = -\frac{ad\cos(c+dx)}{6x^2}-\frac{bd\cos(c+dx)}{2x}-\frac{1}{6}ad^3\cos(c)\,\text{CosIntegral}(dx) -\frac{1}{2}bd^2\,\text{CosIntegral}(dx)\sin(c)-\frac{a\sin(c+dx)}{3x^3}-\frac{b\sin(c+dx)}{2x^2} +\frac{ad^2\sin(c+dx)}{6x}-\frac{1}{2}bd^2\cos(c)\text{Si}(dx)+\frac{1}{6}ad^3\sin(c)\text{Si}(dx)$$

output
```
-1/6*a*d^3*Ci(d*x)*cos(c)-1/6*a*d*cos(d*x+c)/x^2-1/2*b*d*cos(d*x+c)/x-1/2*
b*d^2*cos(c)*Si(d*x)-1/2*b*d^2*Ci(d*x)*sin(c)+1/6*a*d^3*Si(d*x)*sin(c)-1/3
*a*sin(d*x+c)/x^3-1/2*b*sin(d*x+c)/x^2+1/6*a*d^2*sin(d*x+c)/x
```

## 3.8.2 Mathematica [A] (verified)

Time = 0.29 (sec) , antiderivative size = 110, normalized size of antiderivative = 0.83

$$\int \frac{(a+bx)\sin(c+dx)}{x^4}\,dx = -\frac{adx\cos(c+dx)+3bdx^2\cos(c+dx)+d^2x^3\,\text{CosIntegral}(dx)(ad\cos(c)+3b\sin(c))+2a\sin(c+dx)+3}{6x^3}$$

input
```
Integrate[((a + b*x)*Sin[c + d*x])/x^4,x]
```

output
```
-1/6*(a*d*x*Cos[c + d*x] + 3*b*d*x^2*Cos[c + d*x] + d^2*x^3*CosIntegral[d*
x]*(a*d*Cos[c] + 3*b*Sin[c]) + 2*a*Sin[c + d*x] + 3*b*x*Sin[c + d*x] - a*d
^2*x^2*Sin[c + d*x] + d^2*x^3*(3*b*Cos[c] - a*d*Sin[c])*SinIntegral[d*x])/
x^3
```

### 3.8.3 Rubi [A] (verified)

Time = 0.48 (sec) , antiderivative size = 132, normalized size of antiderivative = 1.00, number of steps used = 2, number of rules used = 2, $\frac{\text{number of rules}}{\text{integrand size}}$ = 0.133, Rules used = {7293, 2009}

Below are the steps used by Rubi to obtain the solution. The rule number used for the transformation is given above next to the arrow. The rules definitions used are listed below.

$$\int \frac{(a+bx)\sin(c+dx)}{x^4}\,dx$$

$$\Big\downarrow \text{7293}$$

$$\int \left(\frac{a\sin(c+dx)}{x^4}+\frac{b\sin(c+dx)}{x^3}\right)dx$$

$$\Big\downarrow \text{2009}$$

$$-\frac{1}{6}ad^3\cos(c)\,\text{CosIntegral}(dx)+\frac{1}{6}ad^3\sin(c)\text{Si}(dx)+\frac{ad^2\sin(c+dx)}{6x}-\frac{a\sin(c+dx)}{3x^3}-\frac{ad\cos(c+dx)}{6x^2}-\frac{1}{2}bd^2\sin(c)\,\text{CosIntegral}(dx)-\frac{1}{2}bd^2\cos(c)\text{Si}(dx)-\frac{b\sin(c+dx)}{2x^2}-\frac{bd\cos(c+dx)}{2x}$$

input
```
Int[((a + b*x)*Sin[c + d*x])/x^4,x]
```

output
```
-1/6*(a*d*Cos[c + d*x])/x^2 - (b*d*Cos[c + d*x])/(2*x) - (a*d^3*Cos[c]*Cos
Integral[d*x])/6 - (b*d^2*CosIntegral[d*x]*Sin[c])/2 - (a*Sin[c + d*x])/(3
*x^3) - (b*Sin[c + d*x])/(2*x^2) + (a*d^2*Sin[c + d*x])/(6*x) - (b*d^2*Cos
[c]*SinIntegral[d*x])/2 + (a*d^3*Sin[c]*SinIntegral[d*x])/6
```

#### 3.8.3.1 Defintions of rubi rules used

rule 2009
```
Int[u_, x_Symbol] :> Simp[IntSum[u, x], x] /; SumQ[u]
```

rule 7293
```
Int[u_, x_Symbol] :> With[{v = ExpandIntegrand[u, x]}, Int[v, x] /; SumQ[v]
]
```

### 3.8.4 Maple [A] (verified)

Time = 0.19 (sec) , antiderivative size = 117, normalized size of antiderivative = 0.89

| method | result |
|---|---|
| derivativedivides | $d^3\left(a\left(-\frac{\sin(dx+c)}{3d^3x^3}-\frac{\cos(dx+c)}{6d^2x^2}+\frac{\sin(dx+c)}{6dx}+\frac{\operatorname{Si}(dx)\sin(c)}{6}-\frac{\operatorname{Ci}(dx)\cos(c)}{6}\right)+\frac{b\left(-\frac{\sin(dx+c)}{2d^2x^2}-\frac{\cos(dx+c)}{2dx}\right.}{}\right.$ |
| default | $d^3\left(a\left(-\frac{\sin(dx+c)}{3d^3x^3}-\frac{\cos(dx+c)}{6d^2x^2}+\frac{\sin(dx+c)}{6dx}+\frac{\operatorname{Si}(dx)\sin(c)}{6}-\frac{\operatorname{Ci}(dx)\cos(c)}{6}\right)+\frac{b\left(-\frac{\sin(dx+c)}{2d^2x^2}-\frac{\cos(dx+c)}{2dx}\right.}{}\right.$ |
| risch | $-\frac{i\cos(c)\operatorname{Ei}_1(-idx)b\,d^2}{4}+\frac{i\cos(c)\operatorname{Ei}_1(idx)b\,d^2}{4}+\frac{\cos(c)\operatorname{Ei}_1(-idx)a\,d^3}{12}+\frac{\cos(c)\operatorname{Ei}_1(idx)a\,d^3}{12}+\frac{\sin(c)\operatorname{Ei}_1(-idx)}{4}$ |
| meijerg | $\frac{d^2b\sqrt{\pi}\,\sin(c)\left(-\frac{4}{\sqrt{\pi}\,x^2d^2}-\frac{2\left(2\gamma-3+2\ln(x)+\ln\left(d^2\right)\right)}{\sqrt{\pi}}+\frac{-6d^2x^2+4}{\sqrt{\pi}\,x^2d^2}+\frac{4\gamma}{\sqrt{\pi}}+\frac{4\ln(2)}{\sqrt{\pi}}+\frac{4\ln\left(\frac{dx}{2}\right)}{\sqrt{\pi}}-\frac{4\cos(dx)}{\sqrt{\pi}\,d^2x^2}+\frac{4\sin(dx)}{\sqrt{\pi}\,dx}-\frac{4\operatorname{Ci}(dx)}{\sqrt{\pi}}\right.}{8}$ |

input
```
int((b*x+a)*sin(d*x+c)/x^4,x,method=_RETURNVERBOSE)
```

output
```
d^3*(a*(-1/3*sin(d*x+c)/d^3/x^3-1/6*cos(d*x+c)/d^2/x^2+1/6*sin(d*x+c)/d/x+
1/6*Si(d*x)*sin(c)-1/6*Ci(d*x)*cos(c))+1/d*b*(-1/2*sin(d*x+c)/d^2/x^2-1/2*
cos(d*x+c)/d/x-1/2*Si(d*x)*cos(c)-1/2*Ci(d*x)*sin(c)))
```

### 3.8.5 Fricas [A] (verification not implemented)

Time = 0.26 (sec) , antiderivative size = 108, normalized size of antiderivative = 0.82

$$\int\frac{(a+bx)\sin(c+dx)}{x^4}\,dx =$$
$$-\frac{(3\,bdx^2+adx)\cos(dx+c)+(ad^3x^3\operatorname{Ci}(dx)+3\,bd^2x^3\operatorname{Si}(dx))\cos(c)-(ad^2x^2-3\,bx-2\,a)\sin(dx+c}{6\,x^3}$$

input
```
integrate((b*x+a)*sin(d*x+c)/x^4,x, algorithm="fricas")
```

output
```
-1/6*((3*b*d*x^2 + a*d*x)*cos(d*x + c) + (a*d^3*x^3*cos_integral(d*x) + 3*
b*d^2*x^3*sin_integral(d*x))*cos(c) - (a*d^2*x^2 - 3*b*x - 2*a)*sin(d*x +
c) - (a*d^3*x^3*sin_integral(d*x) - 3*b*d^2*x^3*cos_integral(d*x))*sin(c))
/x^3
```

### 3.8.6 Sympy [F]

$$\int \frac{(a+bx)\sin(c+dx)}{x^4}\,dx = \int \frac{(a+bx)\sin{(c+dx)}}{x^4}\,dx$$

input
```
integrate((b*x+a)*sin(d*x+c)/x**4,x)
```

output
```
Integral((a + b*x)*sin(c + d*x)/x**4, x)
```

### 3.8.7 Maxima [C] (verification not implemented)

Result contains complex when optimal does not.

Time = 0.46 (sec) , antiderivative size = 111, normalized size of antiderivative = 0.84

$$\int \frac{(a+bx)\sin(c+dx)}{x^4}\,dx = -\frac{((a(\Gamma(-3,i\,dx)+\Gamma(-3,-i\,dx))\cos{(c)}+a(-i\,\Gamma(-3,i\,dx)+i\,\Gamma(-3,-i\,dx))\sin{(c)})d^4-3\,(b(-i\,\Gamma(-3,}{2\,dx^3}$$

input
```
integrate((b*x+a)*sin(d*x+c)/x^4,x, algorithm="maxima")
```

output
```
-1/2*(((a*(gamma(-3, I*d*x) + gamma(-3, -I*d*x))*cos(c) + a*(-I*gamma(-3,
I*d*x) + I*gamma(-3, -I*d*x))*sin(c))*d^4 - 3*(b*(-I*gamma(-3, I*d*x) + I*
gamma(-3, -I*d*x))*cos(c) - b*(gamma(-3, I*d*x) + gamma(-3, -I*d*x))*sin(c
))*d^3)*x^3 + 2*b*cos(d*x + c))/(d*x^3)
```

### 3.8.8 Giac [C] (verification not implemented)

Result contains higher order function than in optimal. Order 9 vs. order 4.

Time = 0.31 (sec) , antiderivative size = 961, normalized size of antiderivative = 7.28

$$\int \frac{(a+bx)\sin(c+dx)}{x^4}\,dx = \text{Too large to display}$$

input
```
integrate((b*x+a)*sin(d*x+c)/x^4,x, algorithm="giac")
```

output
```
1/12*(a*d^3*x^3*real_part(cos_integral(d*x))*tan(1/2*d*x)^2*tan(1/2*c)^2 +
 a*d^3*x^3*real_part(cos_integral(-d*x))*tan(1/2*d*x)^2*tan(1/2*c)^2 + 2*a
*d^3*x^3*imag_part(cos_integral(d*x))*tan(1/2*d*x)^2*tan(1/2*c) - 2*a*d^3*
x^3*imag_part(cos_integral(-d*x))*tan(1/2*d*x)^2*tan(1/2*c) + 4*a*d^3*x^3*
sin_integral(d*x)*tan(1/2*d*x)^2*tan(1/2*c) + 3*b*d^2*x^3*imag_part(cos_in
tegral(d*x))*tan(1/2*d*x)^2*tan(1/2*c)^2 - 3*b*d^2*x^3*imag_part(cos_integ
ral(-d*x))*tan(1/2*d*x)^2*tan(1/2*c)^2 + 6*b*d^2*x^3*sin_integral(d*x)*tan
(1/2*d*x)^2*tan(1/2*c)^2 - a*d^3*x^3*real_part(cos_integral(d*x))*tan(1/2*
d*x)^2 - a*d^3*x^3*real_part(cos_integral(-d*x))*tan(1/2*d*x)^2 - 6*b*d^2*
x^3*real_part(cos_integral(d*x))*tan(1/2*d*x)^2*tan(1/2*c) - 6*b*d^2*x^3*r
eal_part(cos_integral(-d*x))*tan(1/2*d*x)^2*tan(1/2*c) + a*d^3*x^3*real_pa
rt(cos_integral(d*x))*tan(1/2*c)^2 + a*d^3*x^3*real_part(cos_integral(-d*x
))*tan(1/2*c)^2 - 3*b*d^2*x^3*imag_part(cos_integral(d*x))*tan(1/2*d*x)^2
+ 3*b*d^2*x^3*imag_part(cos_integral(-d*x))*tan(1/2*d*x)^2 - 6*b*d^2*x^3*s
in_integral(d*x)*tan(1/2*d*x)^2 + 2*a*d^3*x^3*imag_part(cos_integral(d*x))
*tan(1/2*c) - 2*a*d^3*x^3*imag_part(cos_integral(-d*x))*tan(1/2*c) + 4*a*d
^3*x^3*sin_integral(d*x)*tan(1/2*c) + 3*b*d^2*x^3*imag_part(cos_integral(d
*x))*tan(1/2*c)^2 - 3*b*d^2*x^3*imag_part(cos_integral(-d*x))*tan(1/2*c)^2
 + 6*b*d^2*x^3*sin_integral(d*x)*tan(1/2*c)^2 - a*d^3*x^3*real_part(cos_in
tegral(d*x)) - a*d^3*x^3*real_part(cos_integral(-d*x)) - 6*b*d^2*x^3*re...
```

### 3.8.9 Mupad [F(-1)]

Timed out.

$$\int \frac{(a+bx)\sin(c+dx)}{x^4}\,dx = \int \frac{\sin(c+d\,x)\,(a+b\,x)}{x^4}\,dx$$

input
```
int((sin(c + d*x)*(a + b*x))/x^4,x)
```

output
```
int((sin(c + d*x)*(a + b*x))/x^4, x)
```

# 3.9 $\int \frac{(a+bx)\sin(c+dx)}{x^5}\,dx$



## 3.9.1 Optimal result

Integrand size = 15, antiderivative size = 166

$$\int \frac{(a+bx)\sin(c+dx)}{x^5}\,dx = -\frac{ad\cos(c+dx)}{12x^3} - \frac{bd\cos(c+dx)}{6x^2} + \frac{ad^3\cos(c+dx)}{24x} - \frac{1}{6}bd^3\cos(c)\,\text{CosIntegral}(dx) + \frac{1}{24}ad^4\,\text{CosIntegral}(dx)\sin(c) - \frac{a\sin(c+dx)}{4x^4} - \frac{b\sin(c+dx)}{3x^3} + \frac{ad^2\sin(c+dx)}{24x^2} + \frac{bd^2\sin(c+dx)}{6x} + \frac{1}{24}ad^4\cos(c)\text{Si}(dx) + \frac{1}{6}bd^3\sin(c)\text{Si}(dx)$$

output
```
-1/6*b*d^3*Ci(d*x)*cos(c)-1/12*a*d*cos(d*x+c)/x^3-1/6*b*d*cos(d*x+c)/x^2+1
/24*a*d^3*cos(d*x+c)/x+1/24*a*d^4*cos(c)*Si(d*x)+1/24*a*d^4*Ci(d*x)*sin(c)
+1/6*b*d^3*Si(d*x)*sin(c)-1/4*a*sin(d*x+c)/x^4-1/3*b*sin(d*x+c)/x^3+1/24*a
*d^2*sin(d*x+c)/x^2+1/6*b*d^2*sin(d*x+c)/x
```

## 3.9.2 Mathematica [A] (verified)

Time = 0.24 (sec) , antiderivative size = 138, normalized size of antiderivative = 0.83

$$\int \frac{(a+bx)\sin(c+dx)}{x^5}\,dx = \frac{-2adx\cos(c+dx) - 4bdx^2\cos(c+dx) + ad^3x^3\cos(c+dx) + d^3x^4\,\text{CosIntegral}(dx)(-4b\cos(c) + ad\sin(c)}{}$$

input
```
Integrate[((a + b*x)*Sin[c + d*x])/x^5,x]
```

output
```
(-2*a*d*x*Cos[c + d*x] - 4*b*d*x^2*Cos[c + d*x] + a*d^3*x^3*Cos[c + d*x] +
 d^3*x^4*CosIntegral[d*x]*(-4*b*Cos[c] + a*d*Sin[c]) - 6*a*Sin[c + d*x] -
8*b*x*Sin[c + d*x] + a*d^2*x^2*Sin[c + d*x] + 4*b*d^2*x^3*Sin[c + d*x] + d
^3*x^4*(a*d*Cos[c] + 4*b*Sin[c])*SinIntegral[d*x])/(24*x^4)
```

### 3.9.3 Rubi [A] (verified)

Time = 0.53 (sec) , antiderivative size = 166, normalized size of antiderivative = 1.00, number of steps used = 2, number of rules used = 2, $\frac{\text{number of rules}}{\text{integrand size}} = 0.133$, Rules used = {7293, 2009}

Below are the steps used by Rubi to obtain the solution. The rule number used for the transformation is given above next to the arrow. The rules definitions used are listed below.

$$\int \frac{(a+bx)\sin(c+dx)}{x^5}\,dx$$

$$\Big\downarrow \text{7293}$$

$$\int \left(\frac{a\sin(c+dx)}{x^5}+\frac{b\sin(c+dx)}{x^4}\right)dx$$

$$\Big\downarrow \text{2009}$$

$$\frac{1}{24}ad^4\sin(c)\,\text{CosIntegral}(dx)+\frac{1}{24}ad^4\cos(c)\text{Si}(dx)+\frac{ad^3\cos(c+dx)}{24x}+\frac{ad^2\sin(c+dx)}{24x^2}-\frac{a\sin(c+dx)}{4x^4}-\frac{ad\cos(c+dx)}{12x^3}-\frac{1}{6}bd^3\cos(c)\,\text{CosIntegral}(dx)+\frac{1}{6}bd^3\sin(c)\text{Si}(dx)+\frac{bd^2\sin(c+dx)}{6x}-\frac{b\sin(c+dx)}{3x^3}-\frac{bd\cos(c+dx)}{6x^2}$$

input
```
Int[((a + b*x)*Sin[c + d*x])/x^5,x]
```

output
```
-1/12*(a*d*Cos[c + d*x])/x^3 - (b*d*Cos[c + d*x])/(6*x^2) + (a*d^3*Cos[c +
 d*x])/(24*x) - (b*d^3*Cos[c]*CosIntegral[d*x])/6 + (a*d^4*CosIntegral[d*x
]*Sin[c])/24 - (a*Sin[c + d*x])/(4*x^4) - (b*Sin[c + d*x])/(3*x^3) + (a*d^
2*Sin[c + d*x])/(24*x^2) + (b*d^2*Sin[c + d*x])/(6*x) + (a*d^4*Cos[c]*SinI
ntegral[d*x])/24 + (b*d^3*Sin[c]*SinIntegral[d*x])/6
```

#### 3.9.3.1 Defintions of rubi rules used

rule 2009
```
Int[u_, x_Symbol] :> Simp[IntSum[u, x], x] /; SumQ[u]
```

rule 7293
```
Int[u_, x_Symbol] :> With[{v = ExpandIntegrand[u, x]}, Int[v, x] /; SumQ[v]
]
```

### 3.9.4 Maple [A] (verified)

Time = 0.22 (sec) , antiderivative size = 145, normalized size of antiderivative = 0.87

| method | result |
|---|---|
| derivativedivides | $d^4\left(a\left(-\frac{\sin(dx+c)}{4d^4x^4}-\frac{\cos(dx+c)}{12d^3x^3}+\frac{\sin(dx+c)}{24d^2x^2}+\frac{\cos(dx+c)}{24dx}+\frac{\mathrm{Si}(dx)\cos(c)}{24}+\frac{\mathrm{Ci}(dx)\sin(c)}{24}\right)+\frac{b\left(-\frac{\sin(dx}{3d^3x}\right.}{\cdots}\right.$ |
| default | $d^4\left(a\left(-\frac{\sin(dx+c)}{4d^4x^4}-\frac{\cos(dx+c)}{12d^3x^3}+\frac{\sin(dx+c)}{24d^2x^2}+\frac{\cos(dx+c)}{24dx}+\frac{\mathrm{Si}(dx)\cos(c)}{24}+\frac{\mathrm{Ci}(dx)\sin(c)}{24}\right)+\frac{b\left(-\frac{\sin(dx}{3d^3x}\right.}{\cdots}\right.$ |
| risch | $\frac{\cos(c)\,\mathrm{Ei}_1(-idx)b\,d^3}{12}+\frac{\cos(c)\,\mathrm{Ei}_1(idx)b\,d^3}{12}+\frac{i\cos(c)\,\mathrm{Ei}_1(-idx)a\,d^4}{48}-\frac{i\cos(c)\,\mathrm{Ei}_1(idx)a\,d^4}{48}+\frac{i\sin(c)\,\mathrm{Ei}_1(-idx)b}{12}$ |
| meijerg | $\frac{d^4b\sqrt{\pi}\sin(c)\left(-\frac{8(-d^2x^2+2)d^2\cos(x\sqrt{d^2})}{3x^3(d^2)^{\frac{5}{2}}\sqrt{\pi}}+\frac{8\sin(x\sqrt{d^2})}{3d^2x^2\sqrt{\pi}}+\frac{8\,\mathrm{Si}(x\sqrt{d^2})}{3\sqrt{\pi}}\right)}{16\sqrt{d^2}}+\frac{d^3b\sqrt{\pi}\cos(c)\left(-\frac{8}{\sqrt{\pi}x^2d^2}-\frac{4\left(2\gamma-\frac{11}{3}+2\ln(\right.}{3\sqrt{\pi}}\right.}{\cdots}$ |

input
```
int((b*x+a)*sin(d*x+c)/x^5,x,method=_RETURNVERBOSE)
```

output
```
d^4*(a*(-1/4*sin(d*x+c)/d^4/x^4-1/12*cos(d*x+c)/d^3/x^3+1/24*sin(d*x+c)/d^
2/x^2+1/24*cos(d*x+c)/d/x+1/24*Si(d*x)*cos(c)+1/24*Ci(d*x)*sin(c))+1/d*b*(
-1/3*sin(d*x+c)/d^3/x^3-1/6*cos(d*x+c)/d^2/x^2+1/6*sin(d*x+c)/d/x+1/6*Si(d
*x)*sin(c)-1/6*Ci(d*x)*cos(c)))
```

### 3.9.5 Fricas [A] (verification not implemented)

Time = 0.27 (sec) , antiderivative size = 124, normalized size of antiderivative = 0.75

$$\int\frac{(a+bx)\sin(c+dx)}{x^5}\,dx$$
$$=\frac{(ad^3x^3-4\,bdx^2-2\,adx)\cos(dx+c)+(ad^4x^4\,\mathrm{Si}(dx)-4\,bd^3x^4\,\mathrm{Ci}(dx))\cos(c)+(4\,bd^2x^3+ad^2x^2-8\,bx\cdots}{24\,x^4}$$

input
```
integrate((b*x+a)*sin(d*x+c)/x^5,x, algorithm="fricas")
```

output
```
1/24*((a*d^3*x^3 - 4*b*d*x^2 - 2*a*d*x)*cos(d*x + c) + (a*d^4*x^4*sin_inte
gral(d*x) - 4*b*d^3*x^4*cos_integral(d*x))*cos(c) + (4*b*d^2*x^3 + a*d^2*x
^2 - 8*b*x - 6*a)*sin(d*x + c) + (a*d^4*x^4*cos_integral(d*x) + 4*b*d^3*x^
4*sin_integral(d*x))*sin(c))/x^4
```

### 3.9.6 Sympy [F]

$$\int \frac{(a+bx)\sin(c+dx)}{x^5}\,dx = \int \frac{(a+bx)\sin{(c+dx)}}{x^5}\,dx$$

input
```
integrate((b*x+a)*sin(d*x+c)/x**5,x)
```

output
```
Integral((a + b*x)*sin(c + dx)/x**5, x)
```

### 3.9.7 Maxima [C] (verification not implemented)

Result contains complex when optimal does not.

Time = 0.50 (sec) , antiderivative size = 110, normalized size of antiderivative = 0.66

$$\int \frac{(a+bx)\sin(c+dx)}{x^5}\,dx = -\frac{((a(i\,\Gamma(-4,i\,dx)-i\,\Gamma(-4,-i\,dx))\cos{(c)}+a(\Gamma(-4,i\,dx)+\Gamma(-4,-i\,dx))\sin{(c)})d^5-4\,(b(\Gamma(-4,i\,dx)}{2\,dx^4}$$

input
```
integrate((b*x+a)*sin(d*x+c)/x^5,x, algorithm="maxima")
```

output
```
-1/2*(((a*(I*gamma(-4, I*d*x) - I*gamma(-4, -I*d*x))*cos(c) + a*(gamma(-4,
 I*d*x) + gamma(-4, -I*d*x))*sin(c))*d^5 - 4*(b*(gamma(-4, I*d*x) + gamma(
-4, -I*d*x))*cos(c) + b*(-I*gamma(-4, I*d*x) + I*gamma(-4, -I*d*x))*sin(c)
)*d^4)*x^4 + 2*b*cos(d*x + c))/(d*x^4)
```

### 3.9.8 Giac [C] (verification not implemented)

Result contains higher order function than in optimal. Order 9 vs. order 4.

Time = 0.31 (sec) , antiderivative size = 1108, normalized size of antiderivative = 6.67

$$\int \frac{(a+bx)\sin(c+dx)}{x^5}\,dx = \text{Too large to display}$$

input
```
integrate((b*x+a)*sin(d*x+c)/x^5,x, algorithm="giac")
```

output
```
-1/48*(a*d^4*x^4*imag_part(cos_integral(d*x))*tan(1/2*d*x)^2*tan(1/2*c)^2
- a*d^4*x^4*imag_part(cos_integral(-d*x))*tan(1/2*d*x)^2*tan(1/2*c)^2 + 2*
a*d^4*x^4*sin_integral(d*x)*tan(1/2*d*x)^2*tan(1/2*c)^2 - 2*a*d^4*x^4*real
_part(cos_integral(d*x))*tan(1/2*d*x)^2*tan(1/2*c) - 2*a*d^4*x^4*real_part
(cos_integral(-d*x))*tan(1/2*d*x)^2*tan(1/2*c) - 4*b*d^3*x^4*real_part(cos
_integral(d*x))*tan(1/2*d*x)^2*tan(1/2*c)^2 - 4*b*d^3*x^4*real_part(cos_in
tegral(-d*x))*tan(1/2*d*x)^2*tan(1/2*c)^2 - a*d^4*x^4*imag_part(cos_integr
al(d*x))*tan(1/2*d*x)^2 + a*d^4*x^4*imag_part(cos_integral(-d*x))*tan(1/2*
d*x)^2 - 2*a*d^4*x^4*sin_integral(d*x)*tan(1/2*d*x)^2 - 8*b*d^3*x^4*imag_p
art(cos_integral(d*x))*tan(1/2*d*x)^2*tan(1/2*c) + 8*b*d^3*x^4*imag_part(c
os_integral(-d*x))*tan(1/2*d*x)^2*tan(1/2*c) - 16*b*d^3*x^4*sin_integral(d
*x)*tan(1/2*d*x)^2*tan(1/2*c) + a*d^4*x^4*imag_part(cos_integral(d*x))*tan
(1/2*c)^2 - a*d^4*x^4*imag_part(cos_integral(-d*x))*tan(1/2*c)^2 + 2*a*d^4
*x^4*sin_integral(d*x)*tan(1/2*c)^2 + 4*b*d^3*x^4*real_part(cos_integral(d
*x))*tan(1/2*d*x)^2 + 4*b*d^3*x^4*real_part(cos_integral(-d*x))*tan(1/2*d*
x)^2 - 2*a*d^4*x^4*real_part(cos_integral(d*x))*tan(1/2*c) - 2*a*d^4*x^4*r
eal_part(cos_integral(-d*x))*tan(1/2*c) - 4*b*d^3*x^4*real_part(cos_integr
al(d*x))*tan(1/2*c)^2 - 4*b*d^3*x^4*real_part(cos_integral(-d*x))*tan(1/2*
c)^2 - 2*a*d^3*x^3*tan(1/2*d*x)^2*tan(1/2*c)^2 - a*d^4*x^4*imag_part(cos_i
ntegral(d*x)) + a*d^4*x^4*imag_part(cos_integral(-d*x)) - 2*a*d^4*x^4*s...
```

### 3.9.9 Mupad [F(-1)]

Timed out.

$$\int \frac{(a+bx)\sin(c+dx)}{x^5}\,dx = \int \frac{\sin(c+d\,x)\,(a+b\,x)}{x^5}\,dx$$

input
```
int((sin(c + d*x)*(a + b*x))/x^5,x)
```

output
```
int((sin(c + d*x)*(a + b*x))/x^5, x)
```

# 3.10 $\int x^2(a+bx)^2 \sin(c+dx)\,dx$



## 3.10.1 Optimal result

Integrand size = 17, antiderivative size = 186

$$\begin{aligned}\int x^2(a+bx)^2\sin(c+dx)\,dx =& -\frac{24b^2\cos(c+dx)}{d^5}+\frac{2a^2\cos(c+dx)}{d^3}+\frac{12abx\cos(c+dx)}{d^3}\\&+\frac{12b^2x^2\cos(c+dx)}{d^3}-\frac{a^2x^2\cos(c+dx)}{d}-\frac{2abx^3\cos(c+dx)}{d}\\&-\frac{b^2x^4\cos(c+dx)}{d}-\frac{12ab\sin(c+dx)}{d^4}-\frac{24b^2x\sin(c+dx)}{d^4}\\&+\frac{2a^2x\sin(c+dx)}{d^2}+\frac{6abx^2\sin(c+dx)}{d^2}+\frac{4b^2x^3\sin(c+dx)}{d^2}\end{aligned}$$

output
```
-24*b^2*cos(d*x+c)/d^5+2*a^2*cos(d*x+c)/d^3+12*a*b*x*cos(d*x+c)/d^3+12*b^2
*x^2*cos(d*x+c)/d^3-a^2*x^2*cos(d*x+c)/d-2*a*b*x^3*cos(d*x+c)/d-b^2*x^4*co
s(d*x+c)/d-12*a*b*sin(d*x+c)/d^4-24*b^2*x*sin(d*x+c)/d^4+2*a^2*x*sin(d*x+c
)/d^2+6*a*b*x^2*sin(d*x+c)/d^2+4*b^2*x^3*sin(d*x+c)/d^2
```

## 3.10.2 Mathematica [A] (verified)

Time = 0.16 (sec) , antiderivative size = 101, normalized size of antiderivative = 0.54

$$\int x^2(a+bx)^2\sin(c+dx)\,dx$$
$$=\frac{-((2abd^2x(-6+d^2x^2)+a^2d^2(-2+d^2x^2)+b^2(24-12d^2x^2+d^4x^4))\cos(c+dx))+2d(a+2bx)\,(ad^2x+}{d^5}$$

input
```
Integrate[x^2*(a + b*x)^2*Sin[c + d*x],x]
```

output
```
(-((2*a*b*d^2*x*(-6 + d^2*x^2) + a^2*d^2*(-2 + d^2*x^2) + b^2*(24 - 12*d^2
*x^2 + d^4*x^4))*Cos[c + d*x]) + 2*d*(a + 2*b*x)*(a*d^2*x + b*(-6 + d^2*x^
2))*Sin[c + d*x])/d^5
```

### 3.10.3 Rubi [A] (verified)

Time = 0.53 (sec) , antiderivative size = 186, normalized size of antiderivative = 1.00, number of steps used = 2, number of rules used = 2, $\frac{\text{number of rules}}{\text{integrand size}} = 0.118$, Rules used = {7293, 2009}

Below are the steps used by Rubi to obtain the solution. The rule number used for the transformation is given above next to the arrow. The rules definitions used are listed below.

$$\int x^2(a+bx)^2\sin(c+dx)\,dx$$

$$\Big\downarrow \text{ 7293}$$

$$\int \left(a^2x^2\sin(c+dx)+2abx^3\sin(c+dx)+b^2x^4\sin(c+dx)\right)dx$$

$$\Big\downarrow \text{ 2009}$$

$$\frac{2a^2\cos(c+dx)}{d^3}+\frac{2a^2x\sin(c+dx)}{d^2}-\frac{a^2x^2\cos(c+dx)}{d}-\frac{12ab\sin(c+dx)}{d^4}+\frac{12abx\cos(c+dx)}{d^3}+\frac{6abx^2\sin(c+dx)}{d^2}-\frac{2abx^3\cos(c+dx)}{d}-\frac{24b^2\cos(c+dx)}{d^5}-\frac{24b^2x\sin(c+dx)}{d^4}+\frac{12b^2x^2\cos(c+dx)}{d^3}+\frac{4b^2x^3\sin(c+dx)}{d^2}-\frac{b^2x^4\cos(c+dx)}{d}$$

input
```
Int[x^2*(a + b*x)^2*Sin[c + d*x],x]
```

output
```
(-24*b^2*Cos[c + d*x])/d^5 + (2*a^2*Cos[c + d*x])/d^3 + (12*a*b*x*Cos[c +
d*x])/d^3 + (12*b^2*x^2*Cos[c + d*x])/d^3 - (a^2*x^2*Cos[c + d*x])/d - (2*
a*b*x^3*Cos[c + d*x])/d - (b^2*x^4*Cos[c + d*x])/d - (12*a*b*Sin[c + d*x])
/d^4 - (24*b^2*x*Sin[c + d*x])/d^4 + (2*a^2*x*Sin[c + d*x])/d^2 + (6*a*b*x
^2*Sin[c + d*x])/d^2 + (4*b^2*x^3*Sin[c + d*x])/d^2
```

### 3.10.3.1 Defintions of rubi rules used

rule 2009
```
Int[u_, x_Symbol] :> Simp[IntSum[u, x], x] /; SumQ[u]
```

rule 7293
```
Int[u_, x_Symbol] :> With[{v = ExpandIntegrand[u, x]}, Int[v, x] /; SumQ[v]
]
```

## 3.10.4 Maple [A] (verified)

Time = 0.25 (sec) , antiderivative size = 127, normalized size of antiderivative = 0.68

| method | result |
|---|---|
| risch | $-\frac{\left(b^{2} x^{4} d^{4}+2 a b\, d^{4} x^{3}+a^{2} d^{4} x^{2}-12 d^{2} x^{2} b^{2}-12 a b\, d^{2} x-2 d^{2} a^{2}+24 b^{2}\right) \cos \left(d x+c\right)}{d^{5}}+\frac{2\left(2 b^{2} d^{2} x^{3}+3 a b\, d^{2} x^{2}+a^{2} d^{2} x-12 b^{2} x\right.}{d^{4}}$ |
| parallelrisch | $\frac{\left(x \left(b x+a\right) d^{2}-12 b\right) \left(b x+a\right) x\, d^{2} \left(\tan^{2}\left(\frac{d x}{2}+\frac{c}{2}\right)\right)+4 \left(x \left(b x+a\right) d^{2}-6 b\right) d \left(2 b x+a\right) \tan \left(\frac{d x}{2}+\frac{c}{2}\right)-x^{2} \left(b x+a\right)^{2} d^{4}+4 \left(3 x^{2} b^{2}+3 a b\right.}{d^{5} \left(1+\tan^{2}\left(\frac{d x}{2}+\frac{c}{2}\right)\right)}$ |
| norman | $\frac{\frac{4 d^{2} a^{2}-48 b^{2}}{d^{5}}+\frac{b^{2} x^{4} \left(\tan^{2}\left(\frac{d x}{2}+\frac{c}{2}\right)\right)}{d}+\frac{\left(d^{2} a^{2}-12 b^{2}\right) x^{2} \left(\tan^{2}\left(\frac{d x}{2}+\frac{c}{2}\right)\right)}{d^{3}}-\frac{b^{2} x^{4}}{d}-\frac{\left(d^{2} a^{2}-12 b^{2}\right) x^{2}}{d^{3}}-\frac{24 a b \tan \left(\frac{d x}{2}+\frac{c}{2}\right)}{d^{4}}+\frac{8 b^{2} x^{3} \tan}{d}}{1+\tan^{2}}$ |
| parts | $-\frac{b^{2} x^{4} \cos \left(d x+c\right)}{d}-\frac{2 a b\, x^{3} \cos \left(d x+c\right)}{d}-\frac{a^{2} x^{2} \cos \left(d x+c\right)}{d}+\frac{-\frac{2 a^{2} c \sin \left(d x+c\right)}{d}+\frac{2 a^{2} \left(\cos \left(d x+c\right)+\left(d x+c\right) \sin \left(d x+c\right)\right)}{d}+\frac{6 a b}{}}{}$ |
| meijerg | $\frac{16 b^{2} \sqrt{\pi}\, \sin \left(c\right) \left(-\frac{x \left(d^{2}\right)^{\frac{5}{2}} \left(-\frac{5 d^{2} x^{2}}{2}+15\right) \cos \left(d x\right)}{10 \sqrt{\pi}\, d^{4}}+\frac{\left(d^{2}\right)^{\frac{5}{2}} \left(\frac{5}{8} d^{4} x^{4}-\frac{15}{2} d^{2} x^{2}+15\right) \sin \left(d x\right)}{10 \sqrt{\pi}\, d^{5}}\right)}{d^{4} \sqrt{d^{2}}}+\frac{16 b^{2} \sqrt{\pi}\, \cos \left(c\right) \left(\frac{3}{2 \sqrt{\pi}}-\frac{\left(\frac{3}{8} d^{4}\right.}{}\right.}{}$ |
| derivativedivides | $\frac{-a^{2} c^{2} \cos \left(d x+c\right)-2 a^{2} c \left(\sin \left(d x+c\right)-\cos \left(d x+c\right) \left(d x+c\right)\right)+a^{2} \left(-\left(d x+c\right)^{2} \cos \left(d x+c\right)+2 \cos \left(d x+c\right)+2 \left(d x+c\right) \sin \left(d x+c\right)\right)+}{}$ |
| default | $\frac{-a^{2} c^{2} \cos \left(d x+c\right)-2 a^{2} c \left(\sin \left(d x+c\right)-\cos \left(d x+c\right) \left(d x+c\right)\right)+a^{2} \left(-\left(d x+c\right)^{2} \cos \left(d x+c\right)+2 \cos \left(d x+c\right)+2 \left(d x+c\right) \sin \left(d x+c\right)\right)+}{}$ |

input
```
int(x^2*(b*x+a)^2*sin(d*x+c),x,method=_RETURNVERBOSE)
```

output
```
-(b^2*d^4*x^4+2*a*b*d^4*x^3+a^2*d^4*x^2-12*b^2*d^2*x^2-12*a*b*d^2*x-2*a^2*
d^2+24*b^2)/d^5*cos(d*x+c)+2/d^4*(2*b^2*d^2*x^3+3*a*b*d^2*x^2+a^2*d^2*x-12
*b^2*x-6*a*b)*sin(d*x+c)
```

### 3.10.5 Fricas [A] (verification not implemented)

Time = 0.28 (sec) , antiderivative size = 126, normalized size of antiderivative = 0.68

$$\int x^2(a+bx)^2\sin(c+dx)\,dx = -\frac{(b^2d^4x^4+2\,abd^4x^3-12\,abd^2x-2\,a^2d^2+(a^2d^4-12\,b^2d^2)x^2+24\,b^2)\cos(dx+c)-2\,(2\,b^2d^3x^3+3\,abd}{d^5}$$

input
```
integrate(x^2*(b*x+a)^2*sin(d*x+c),x, algorithm="fricas")
```

output
```
-((b^2*d^4*x^4 + 2*a*b*d^4*x^3 - 12*a*b*d^2*x - 2*a^2*d^2 + (a^2*d^4 - 12*
b^2*d^2)*x^2 + 24*b^2)*cos(d*x + c) - 2*(2*b^2*d^3*x^3 + 3*a*b*d^3*x^2 - 6
*a*b*d + (a^2*d^3 - 12*b^2*d)*x)*sin(d*x + c))/d^5
```

### 3.10.6 Sympy [A] (verification not implemented)

Time = 0.34 (sec) , antiderivative size = 228, normalized size of antiderivative = 1.23

$$\int x^2(a+bx)^2\sin(c+dx)\,dx = \begin{cases} -\frac{a^2x^2\cos(c+dx)}{d}+\frac{2a^2x\sin(c+dx)}{d^2}+\frac{2a^2\cos(c+dx)}{d^3}-\frac{2abx^3\cos(c+dx)}{d}+\frac{6abx^2\sin(c+dx)}{d^2}+\frac{12abx\cos(c+dx)}{d^3}-\frac{12ab\sin(c+d}{d^4} \\ \left(\frac{a^2x^3}{3}+\frac{abx^4}{2}+\frac{b^2x^5}{5}\right)\sin(c) \end{cases}$$

input
```
integrate(x**2*(b*x+a)**2*sin(d*x+c),x)
```

output
```
Piecewise((-a**2*x**2*cos(c + d*x)/d + 2*a**2*x*sin(c + d*x)/d**2 + 2*a**2
*cos(c + d*x)/d**3 - 2*a*b*x**3*cos(c + d*x)/d + 6*a*b*x**2*sin(c + d*x)/d
**2 + 12*a*b*x*cos(c + d*x)/d**3 - 12*a*b*sin(c + d*x)/d**4 - b**2*x**4*co
s(c + d*x)/d + 4*b**2*x**3*sin(c + d*x)/d**2 + 12*b**2*x**2*cos(c + d*x)/d
**3 - 24*b**2*x*sin(c + d*x)/d**4 - 24*b**2*cos(c + d*x)/d**5, Ne(d, 0)),
((a**2*x**3/3 + a*b*x**4/2 + b**2*x**5/5)*sin(c), True))
```

### 3.10.7 Maxima [B] (verification not implemented)

Leaf count of result is larger than twice the leaf count of optimal. 406 vs. $2(186) = 372$.

Time = 0.21 (sec) , antiderivative size = 406, normalized size of antiderivative = 2.18

$$\int x^2(a+bx)^2\sin(c+dx)\,dx =$$

$$-\frac{a^2c^2\cos(dx+c)+\frac{b^2c^4\cos(dx+c)}{d^2}-\frac{2\,abc^3\cos(dx+c)}{d}-2\,((dx+c)\cos(dx+c)-\sin(dx+c))a^2c-\frac{4\,((dx+c)\,c}{}}{}$$

input
```
integrate(x^2*(b*x+a)^2*sin(d*x+c),x, algorithm="maxima")
```

output
```
-(a^2*c^2*cos(d*x + c) + b^2*c^4*cos(d*x + c)/d^2 - 2*a*b*c^3*cos(d*x + c)
/d - 2*((d*x + c)*cos(d*x + c) - sin(d*x + c))*a^2*c - 4*((d*x + c)*cos(d*
x + c) - sin(d*x + c))*b^2*c^3/d^2 + 6*((d*x + c)*cos(d*x + c) - sin(d*x +
 c))*a*b*c^2/d + (((d*x + c)^2 - 2)*cos(d*x + c) - 2*(d*x + c)*sin(d*x + c
))*a^2 + 6*(((d*x + c)^2 - 2)*cos(d*x + c) - 2*(d*x + c)*sin(d*x + c))*b^2
*c^2/d^2 - 6*(((d*x + c)^2 - 2)*cos(d*x + c) - 2*(d*x + c)*sin(d*x + c))*a
*b*c/d - 4*(((d*x + c)^3 - 6*d*x - 6*c)*cos(d*x + c) - 3*((d*x + c)^2 - 2)
*sin(d*x + c))*b^2*c/d^2 + 2*(((d*x + c)^3 - 6*d*x - 6*c)*cos(d*x + c) - 3
*((d*x + c)^2 - 2)*sin(d*x + c))*a*b/d + (((d*x + c)^4 - 12*(d*x + c)^2 +
24)*cos(d*x + c) - 4*((d*x + c)^3 - 6*d*x - 6*c)*sin(d*x + c))*b^2/d^2)/d^
3
```

### 3.10.8 Giac [A] (verification not implemented)

Time = 0.29 (sec) , antiderivative size = 128, normalized size of antiderivative = 0.69

$$\int x^2(a+bx)^2\sin(c+dx)\,dx = -\frac{(b^2d^4x^4+2\,abd^4x^3+a^2d^4x^2-12\,b^2d^2x^2-12\,abd^2x-2\,a^2d^2+24\,b^2)\cos(dx+c)}{d^5} + \frac{2\,(2\,b^2d^3x^3+3\,abd^3x^2+a^2d^3x-12\,b^2dx-6\,abd)\sin(dx+c)}{d^5}$$

input
```
integrate(x^2*(b*x+a)^2*sin(d*x+c),x, algorithm="giac")
```

output
```
-(b^2*d^4*x^4 + 2*a*b*d^4*x^3 + a^2*d^4*x^2 - 12*b^2*d^2*x^2 - 12*a*b*d^2*
x - 2*a^2*d^2 + 24*b^2)*cos(d*x + c)/d^5 + 2*(2*b^2*d^3*x^3 + 3*a*b*d^3*x^
2 + a^2*d^3*x - 12*b^2*d*x - 6*a*b*d)*sin(d*x + c)/d^5
```

### 3.10.9 Mupad [B] (verification not implemented)

Time = 0.33 (sec) , antiderivative size = 172, normalized size of antiderivative = 0.92

$$\int x^2(a+bx)^2\sin(c+dx)\,dx = \frac{4\,b^2\,x^3\,\sin\left(c+d\,x\right)}{d^2}-\frac{b^2\,x^4\,\cos\left(c+d\,x\right)}{d} -\frac{2\,\cos\left(c+d\,x\right)\,\left(12\,b^2-a^2\,d^2\right)}{d^5}-\frac{12\,a\,b\,\sin\left(c+d\,x\right)}{d^4} -\frac{2\,x\,\sin\left(c+d\,x\right)\,\left(12\,b^2-a^2\,d^2\right)}{d^4} +\frac{x^2\,\cos\left(c+d\,x\right)\,\left(12\,b^2-a^2\,d^2\right)}{d^3}-\frac{2\,a\,b\,x^3\,\cos\left(c+d\,x\right)}{d} +\frac{6\,a\,b\,x^2\,\sin\left(c+d\,x\right)}{d^2}+\frac{12\,a\,b\,x\,\cos\left(c+d\,x\right)}{d^3}$$

input
```
int(x^2*sin(c + d*x)*(a + b*x)^2,x)
```

output
```
(4*b^2*x^3*sin(c + d*x))/d^2 - (b^2*x^4*cos(c + d*x))/d - (2*cos(c + d*x)*
(12*b^2 - a^2*d^2))/d^5 - (12*a*b*sin(c + d*x))/d^4 - (2*x*sin(c + d*x)*(1
2*b^2 - a^2*d^2))/d^4 + (x^2*cos(c + d*x)*(12*b^2 - a^2*d^2))/d^3 - (2*a*b
*x^3*cos(c + d*x))/d + (6*a*b*x^2*sin(c + d*x))/d^2 + (12*a*b*x*cos(c + d*
x))/d^3
```

# 3.11 $\int x(a+bx)^2 \sin(c+dx)\,dx$



## 3.11.1 Optimal result

Integrand size = 15, antiderivative size = 135

$$\int x(a+bx)^2\sin(c+dx)\,dx = \frac{4ab\cos(c+dx)}{d^3}+\frac{6b^2x\cos(c+dx)}{d^3}-\frac{a^2x\cos(c+dx)}{d} -\frac{2abx^2\cos(c+dx)}{d}-\frac{b^2x^3\cos(c+dx)}{d}-\frac{6b^2\sin(c+dx)}{d^4} +\frac{a^2\sin(c+dx)}{d^2}+\frac{4abx\sin(c+dx)}{d^2}+\frac{3b^2x^2\sin(c+dx)}{d^2}$$

output
```
4*a*b*cos(d*x+c)/d^3+6*b^2*x*cos(d*x+c)/d^3-a^2*x*cos(d*x+c)/d-2*a*b*x^2*c
os(d*x+c)/d-b^2*x^3*cos(d*x+c)/d-6*b^2*sin(d*x+c)/d^4+a^2*sin(d*x+c)/d^2+4
*a*b*x*sin(d*x+c)/d^2+3*b^2*x^2*sin(d*x+c)/d^2
```

## 3.11.2 Mathematica [A] (verified)

Time = 0.13 (sec) , antiderivative size = 87, normalized size of antiderivative = 0.64

$$\int x(a+bx)^2\sin(c+dx)\,dx = \frac{-d(a^2d^2x+b^2x(-6+d^2x^2)+2ab(-2+d^2x^2))\cos(c+dx)+(a^2d^2+4abd^2x+3b^2(-2+d^2x^2))\sin(c+}{d^4}$$

input
```
Integrate[x*(a + b*x)^2*Sin[c + d*x],x]
```

output
```
(-(d*(a^2*d^2*x + b^2*x*(-6 + d^2*x^2) + 2*a*b*(-2 + d^2*x^2))*Cos[c + d*x
]) + (a^2*d^2 + 4*a*b*d^2*x + 3*b^2*(-2 + d^2*x^2))*Sin[c + d*x])/d^4
```

## 3.11.3 Rubi [A] (verified)

Time = 0.39 (sec) , antiderivative size = 135, normalized size of antiderivative = 1.00, number of steps used = 2, number of rules used = 2, $\frac{\text{number of rules}}{\text{integrand size}}$ = 0.133, Rules used = {7293, 2009}

Below are the steps used by Rubi to obtain the solution. The rule number used for the transformation is given above next to the arrow. The rules definitions used are listed below.

$$\int x(a+bx)^2\sin(c+dx)\,dx$$

$$\Big\downarrow \text{7293}$$

$$\int \left(a^2x\sin(c+dx)+2abx^2\sin(c+dx)+b^2x^3\sin(c+dx)\right)dx$$

$$\Big\downarrow \text{2009}$$

$$\frac{a^2\sin(c+dx)}{d^2}-\frac{a^2x\cos(c+dx)}{d}+\frac{4ab\cos(c+dx)}{d^3}+\frac{4abx\sin(c+dx)}{d^2}-\frac{2abx^2\cos(c+dx)}{d}-\frac{6b^2\sin(c+dx)}{d^4}+\frac{6b^2x\cos(c+dx)}{d^3}+\frac{3b^2x^2\sin(c+dx)}{d^2}-\frac{b^2x^3\cos(c+dx)}{d}$$

input
```
Int[x*(a + b*x)^2*Sin[c + d*x],x]
```

output
```
(4*a*b*Cos[c + d*x])/d^3 + (6*b^2*x*Cos[c + d*x])/d^3 - (a^2*x*Cos[c + d*x
])/d - (2*a*b*x^2*Cos[c + d*x])/d - (b^2*x^3*Cos[c + d*x])/d - (6*b^2*Sin[
c + d*x])/d^4 + (a^2*Sin[c + d*x])/d^2 + (4*a*b*x*Sin[c + d*x])/d^2 + (3*b
^2*x^2*Sin[c + d*x])/d^2
```

### 3.11.3.1 Defintions of rubi rules used

rule 2009
```
Int[u_, x_Symbol] :> Simp[IntSum[u, x], x] /; SumQ[u]
```

rule 7293
```
Int[u_, x_Symbol] :> With[{v = ExpandIntegrand[u, x]}, Int[v, x] /; SumQ[v]
]
```

### 3.11.4 Maple [A] (verified)

Time = 0.25 (sec) , antiderivative size = 94, normalized size of antiderivative = 0.70

| method | result |
|---|---|
| risch | $-\frac{(b^2d^2x^3+2ab\,d^2x^2+a^2d^2x-6b^2x-4ab)\cos(dx+c)}{d^3}+\frac{(3d^2x^2b^2+4ab\,d^2x+d^2a^2-6b^2)\sin(dx+c)}{d^4}$ |
| parallelrisch | $\frac{\left((bx+a)^2d^2-6b^2\right)xd\left(\tan^2\left(\frac{dx}{2}+\frac{c}{2}\right)\right)+2((3x^2b^2+4abx+a^2)d^2-6b^2)\tan\left(\frac{dx}{2}+\frac{c}{2}\right)-d\left(x(bx+a)^2d^2-6b^2x-8ab\right)}{d^4\left(1+\tan^2\left(\frac{dx}{2}+\frac{c}{2}\right)\right)}$ |
| parts | $-\frac{b^2x^3\cos(dx+c)}{d}-\frac{2ab\,x^2\cos(dx+c)}{d}-\frac{a^2x\cos(dx+c)}{d}+\frac{a^2\sin(dx+c)-\frac{4abc\sin(dx+c)}{d}+\frac{4ab(\cos(dx+c)+(dx+c)\sin(}{d}}{}$ |
| norman | $\frac{\frac{b^2x^3\left(\tan^2\left(\frac{dx}{2}+\frac{c}{2}\right)\right)}{d}+\frac{(d^2a^2-6b^2)x\left(\tan^2\left(\frac{dx}{2}+\frac{c}{2}\right)\right)}{d^3}-\frac{b^2x^3}{d}-\frac{(d^2a^2-6b^2)x}{d^3}+\frac{2(d^2a^2-6b^2)\tan\left(\frac{dx}{2}+\frac{c}{2}\right)}{d^4}-\frac{8ab\left(\tan^2\left(\frac{dx}{2}+\frac{c}{2}\right)\right)}{d^3}}{1+\tan^2\left(\frac{dx}{2}+\frac{c}{2}\right)}$ |
| derivativedivides | $\frac{a^2c\cos(dx+c)+a^2(\sin(dx+c)-\cos(dx+c)(dx+c))-\frac{2ab\,c^2\cos(dx+c)}{d}-\frac{4abc(\sin(dx+c)-\cos(dx+c)(dx+c))}{d}+\frac{2ab\left(-(dx+c)^2\cos\right.}{}}{}$ |
| default | $\frac{a^2c\cos(dx+c)+a^2(\sin(dx+c)-\cos(dx+c)(dx+c))-\frac{2ab\,c^2\cos(dx+c)}{d}-\frac{4abc(\sin(dx+c)-\cos(dx+c)(dx+c))}{d}+\frac{2ab\left(-(dx+c)^2\cos\right.}{}}{}$ |
| meijerg | $\frac{8b^2\sqrt{\pi}\,\sin(c)\left(\frac{3}{4\sqrt{\pi}}-\frac{\left(-\frac{3d^2x^2}{2}+3\right)\cos(dx)}{4\sqrt{\pi}}-\frac{dx\left(-\frac{d^2x^2}{2}+3\right)\sin(dx)}{4\sqrt{\pi}}\right)}{d^4}+\frac{8b^2\sqrt{\pi}\,\cos(c)\left(\frac{xd\left(-\frac{5d^2x^2}{2}+15\right)\cos(dx)}{20\sqrt{\pi}}-\frac{(-1}{}\right.}{d^4}$ |

input
```
int(x*(b*x+a)^2*sin(d*x+c),x,method=_RETURNVERBOSE)
```

output
```
-1/d^3*(b^2*d^2*x^3+2*a*b*d^2*x^2+a^2*d^2*x-6*b^2*x-4*a*b)*cos(d*x+c)+(3*b
^2*d^2*x^2+4*a*b*d^2*x+a^2*d^2-6*b^2)/d^4*sin(d*x+c)
```

### 3.11.5 Fricas [A] (verification not implemented)

Time = 0.29 (sec) , antiderivative size = 95, normalized size of antiderivative = 0.70

$$\int x(a+bx)^2\sin(c+dx)\,dx = -\frac{(b^2d^3x^3+2\,abd^3x^2-4\,abd+(a^2d^3-6\,b^2d)x)\cos(dx+c)-(3\,b^2d^2x^2+4\,abd^2x+a^2d^2-6\,b^2)\sin(dx}{d^4}$$

input
```
integrate(x*(b*x+a)^2*sin(d*x+c),x, algorithm="fricas")
```

output
```
-((b^2*d^3*x^3 + 2*a*b*d^3*x^2 - 4*a*b*d + (a^2*d^3 - 6*b^2*d)*x)*cos(d*x
+ c) - (3*b^2*d^2*x^2 + 4*a*b*d^2*x + a^2*d^2 - 6*b^2)*sin(d*x + c))/d^4
```

### 3.11.6 Sympy [A] (verification not implemented)

Time = 0.27 (sec) , antiderivative size = 172, normalized size of antiderivative = 1.27

$$\int x(a+bx)^2\sin(c+dx)\,dx$$
$$=\begin{cases}-\frac{a^2x\cos{(c+dx)}}{d}+\frac{a^2\sin{(c+dx)}}{d^2}-\frac{2abx^2\cos{(c+dx)}}{d}+\frac{4abx\sin{(c+dx)}}{d^2}+\frac{4ab\cos{(c+dx)}}{d^3}-\frac{b^2x^3\cos{(c+dx)}}{d}+\frac{3b^2x^2\sin{(c+dx)}}{d^2}+ \\ \left(\frac{a^2x^2}{2}+\frac{2abx^3}{3}+\frac{b^2x^4}{4}\right)\sin{(c)}\end{cases}$$

input
```
integrate(x*(b*x+a)**2*sin(d*x+c),x)
```

output
```
Piecewise((-a**2*x*cos(c + d*x)/d + a**2*sin(c + d*x)/d**2 - 2*a*b*x**2*co
s(c + d*x)/d + 4*a*b*x*sin(c + d*x)/d**2 + 4*a*b*cos(c + d*x)/d**3 - b**2*
x**3*cos(c + d*x)/d + 3*b**2*x**2*sin(c + d*x)/d**2 + 6*b**2*x*cos(c + d*x
)/d**3 - 6*b**2*sin(c + d*x)/d**4, Ne(d, 0)), ((a**2*x**2/2 + 2*a*b*x**3/3
 + b**2*x**4/4)*sin(c), True))
```

### 3.11.7 Maxima [A] (verification not implemented)

Time = 0.20 (sec) , antiderivative size = 259, normalized size of antiderivative = 1.92

$$\int x(a+bx)^2\sin(c+dx)\,dx$$
$$=\frac{a^2c\cos{(dx+c)}+\frac{b^2c^3\cos(dx+c)}{d^2}-\frac{2\,abc^2\cos(dx+c)}{d}-((dx+c)\cos{(dx+c)}-\sin{(dx+c)})a^2-\frac{3\,((dx+c)\cos(dx+c}{d^2}}{}$$

input
```
integrate(x*(b*x+a)^2*sin(d*x+c),x, algorithm="maxima")
```

output
```
(a^2*c*cos(d*x + c) + b^2*c^3*cos(d*x + c)/d^2 - 2*a*b*c^2*cos(d*x + c)/d
- ((d*x + c)*cos(d*x + c) - sin(d*x + c))*a^2 - 3*((d*x + c)*cos(d*x + c)
- sin(d*x + c))*b^2*c^2/d^2 + 4*((d*x + c)*cos(d*x + c) - sin(d*x + c))*a*
b*c/d + 3*(((d*x + c)^2 - 2)*cos(d*x + c) - 2*(d*x + c)*sin(d*x + c))*b^2*
c/d^2 - 2*(((d*x + c)^2 - 2)*cos(d*x + c) - 2*(d*x + c)*sin(d*x + c))*a*b/
d - (((d*x + c)^3 - 6*d*x - 6*c)*cos(d*x + c) - 3*((d*x + c)^2 - 2)*sin(d*
x + c))*b^2/d^2)/d^2
```

### 3.11.8 Giac [A] (verification not implemented)

Time = 0.27 (sec) , antiderivative size = 95, normalized size of antiderivative = 0.70

$$\int x(a+bx)^2\sin(c+dx)\,dx = -\frac{(b^2d^3x^3+2\,abd^3x^2+a^2d^3x-6\,b^2dx-4\,abd)\cos{(dx+c)}}{d^4} + \frac{(3\,b^2d^2x^2+4\,abd^2x+a^2d^2-6\,b^2)\sin{(dx+c)}}{d^4}$$

input
```
integrate(x*(b*x+a)^2*sin(d*x+c),x, algorithm="giac")
```

output
```
-(b^2*d^3*x^3 + 2*a*b*d^3*x^2 + a^2*d^3*x - 6*b^2*d*x - 4*a*b*d)*cos(d*x +
 c)/d^4 + (3*b^2*d^2*x^2 + 4*a*b*d^2*x + a^2*d^2 - 6*b^2)*sin(d*x + c)/d^4
```

### 3.11.9 Mupad [B] (verification not implemented)

Time = 6.03 (sec) , antiderivative size = 128, normalized size of antiderivative = 0.95

$$\int x(a+bx)^2\sin(c+dx)\,dx = \frac{3\,b^2\,x^2\,\sin{(c+d\,x)}}{d^2} - \frac{b^2\,x^3\,\cos{(c+d\,x)}}{d} - \frac{\sin{(c+d\,x)}\,(6\,b^2-a^2\,d^2)}{d^4} + \frac{4\,a\,b\,\cos{(c+d\,x)}}{d^3} + \frac{x\,\cos{(c+d\,x)}\,(6\,b^2-a^2\,d^2)}{d^3} - \frac{2\,a\,b\,x^2\,\cos{(c+d\,x)}}{d} + \frac{4\,a\,b\,x\,\sin{(c+d\,x)}}{d^2}$$

input
```
int(x*sin(c + d*x)*(a + b*x)^2,x)
```

output
```
(3*b^2*x^2*sin(c + d*x))/d^2 - (b^2*x^3*cos(c + d*x))/d - (sin(c + d*x)*(6
*b^2 - a^2*d^2))/d^4 + (4*a*b*cos(c + d*x))/d^3 + (x*cos(c + d*x)*(6*b^2 -
 a^2*d^2))/d^3 - (2*a*b*x^2*cos(c + d*x))/d + (4*a*b*x*sin(c + d*x))/d^2
```

# 3.12 $\int (a+bx)^2 \sin(c+dx)\,dx$



## 3.12.1 Optimal result

Integrand size = 14, antiderivative size = 50

$$\int (a+bx)^2 \sin(c+dx)\,dx = \frac{2b^2\cos(c+dx)}{d^3} - \frac{(a+bx)^2\cos(c+dx)}{d} + \frac{2b(a+bx)\sin(c+dx)}{d^2}$$

output
```
2*b^2*cos(d*x+c)/d^3-(b*x+a)^2*cos(d*x+c)/d+2*b*(b*x+a)*sin(d*x+c)/d^2
```

## 3.12.2 Mathematica [A] (verified)

Time = 0.13 (sec) , antiderivative size = 57, normalized size of antiderivative = 1.14

$$\int (a+bx)^2 \sin(c+dx)\,dx = \frac{-\left((a^2d^2+2abd^2x+b^2(-2+d^2x^2))\cos(c+dx)\right)+2bd(a+bx)\sin(c+dx)}{d^3}$$

input
```
Integrate[(a + b*x)^2*Sin[c + d*x],x]
```

output
```
(-((a^2*d^2 + 2*a*b*d^2*x + b^2*(-2 + d^2*x^2))*Cos[c + d*x]) + 2*b*d*(a +
 b*x)*Sin[c + d*x])/d^3
```

### 3.12.3 Rubi [A] (verified)

Time = 0.32 (sec) , antiderivative size = 52, normalized size of antiderivative = 1.04, number of steps used = 7, number of rules used = 7, $\frac{\text{number of rules}}{\text{integrand size}}$ = 0.500, Rules used = {3042, 3777, 3042, 3777, 25, 3042, 3118}

Below are the steps used by Rubi to obtain the solution. The rule number used for the transformation is given above next to the arrow. The rules definitions used are listed below.

$$\int (a+bx)^2\sin(c+dx)\,dx$$

$$\Big\downarrow \text{3042}$$

$$\int (a+bx)^2\sin(c+dx)dx$$

$$\Big\downarrow \text{3777}$$

$$\frac{2b\int (a+bx)\cos(c+dx)dx}{d}-\frac{(a+bx)^2\cos(c+dx)}{d}$$

$$\Big\downarrow \text{3042}$$

$$\frac{2b\int (a+bx)\sin\left(c+dx+\frac{\pi}{2}\right)dx}{d}-\frac{(a+bx)^2\cos(c+dx)}{d}$$

$$\Big\downarrow \text{3777}$$

$$\frac{2b\left(\frac{b\int -\sin(c+dx)dx}{d}+\frac{(a+bx)\sin(c+dx)}{d}\right)}{d}-\frac{(a+bx)^2\cos(c+dx)}{d}$$

$$\Big\downarrow \text{25}$$

$$\frac{2b\left(\frac{(a+bx)\sin(c+dx)}{d}-\frac{b\int \sin(c+dx)dx}{d}\right)}{d}-\frac{(a+bx)^2\cos(c+dx)}{d}$$

$$\Big\downarrow \text{3042}$$

$$\frac{2b\left(\frac{(a+bx)\sin(c+dx)}{d}-\frac{b\int \sin(c+dx)dx}{d}\right)}{d}-\frac{(a+bx)^2\cos(c+dx)}{d}$$

$$\Big\downarrow \text{3118}$$

$$\frac{2b\left(\frac{(a+bx)\sin(c+dx)}{d}+\frac{b\cos(c+dx)}{d^2}\right)}{d}-\frac{(a+bx)^2\cos(c+dx)}{d}$$

input
```
Int[(a + b*x)^2*Sin[c + d*x],x]
```

output
```
-(((a + b*x)^2*Cos[c + d*x])/d) + (2*b*((b*Cos[c + d*x])/d^2 + ((a + b*x)*
Sin[c + d*x])/d))/d
```

#### 3.12.3.1 Defintions of rubi rules used

rule 25
```
Int[-(Fx_), x_Symbol] :> Simp[Identity[-1]   Int[Fx, x], x]
```

rule 3042
```
Int[u_, x_Symbol] :> Int[DeactivateTrig[u, x], x] /; FunctionOfTrigOfLinear
Q[u, x]
```

rule 3118
```
Int[sin[(c_.) + (d_.)*(x_)], x_Symbol] :> Simp[-Cos[c + d*x]/d, x] /; FreeQ
[{c, d}, x]
```

rule 3777
```
Int[((c_.) + (d_.)*(x_))^(m_.)*sin[(e_.) + (f_.)*(x_)], x_Symbol] :> Simp[(
-(c + d*x)^m)*(Cos[e + f*x]/f), x] + Simp[d*(m/f)   Int[(c + d*x)^(m - 1)*C
os[e + f*x], x], x] /; FreeQ[{c, d, e, f}, x] && GtQ[m, 0]
```

### 3.12.4 Maple [A] (verified)

Time = 0.22 (sec) , antiderivative size = 61, normalized size of antiderivative = 1.22

| method | result |
|---|---|
| risch | $-\frac{\left(d^{2} x^{2} b^{2}+2 a b\,d^{2} x+d^{2} a^{2}-2 b^{2}\right) \cos \left(d x+c\right)}{d^{3}}+\frac{2 b \left(b x+a\right) \sin \left(d x+c\right)}{d^{2}}$ |
| parallelrisch | $\frac{2\left(\frac{b x}{2}+a\right) x\,d^{2} b\left(\tan^{2}\left(\frac{d x}{2}+\frac{c}{2}\right)\right)+4 b d \left(b x+a\right) \tan\left(\frac{d x}{2}+\frac{c}{2}\right)+\left(-x^{2} b^{2}-2 a b x-2 a^{2}\right) d^{2}+4 b^{2}}{d^{3} \left(1+\tan^{2}\left(\frac{d x}{2}+\frac{c}{2}\right)\right)}$ |
| parts | $-\frac{b^{2} x^{2} \cos \left(d x+c\right)}{d}-\frac{2 a b x \cos \left(d x+c\right)}{d}-\frac{a^{2} \cos \left(d x+c\right)}{d}+\frac{2 b \left(a \sin \left(d x+c\right)-\frac{b c \sin \left(d x+c\right)}{d}+\frac{b (\cos (d x+c)+(d x+c) \sin (d x+c}{d} \cdots\right.}{d^{2}}$ |
| norman | $\frac{\frac{b^{2} x^{2} \left(\tan^{2}\left(\frac{d x}{2}+\frac{c}{2}\right)\right)}{d}-\frac{2 d^{2} a^{2}-4 b^{2}}{d^{3}}-\frac{b^{2} x^{2}}{d}+\frac{4 b^{2} x \tan \left(\frac{d x}{2}+\frac{c}{2}\right)}{d^{2}}+\frac{4 a b \tan \left(\frac{d x}{2}+\frac{c}{2}\right)}{d^{2}}-\frac{2 a b x}{d}+\frac{2 a b x \left(\tan^{2}\left(\frac{d x}{2}+\frac{c}{2}\right)\right)}{d}}{1+\tan^{2}\left(\frac{d x}{2}+\frac{c}{2}\right)}$ |
| derivativedivides | $\frac{-a^{2} \cos \left(d x+c\right)+\frac{2 a b c \cos \left(d x+c\right)}{d}+\frac{2 a b (\sin (d x+c)-\cos (d x+c) (d x+c))}{d}-\frac{b^{2} c^{2} \cos \left(d x+c\right)}{d^{2}}-\frac{2 b^{2} c (\sin (d x+c)-\cos (d x+c) (d x+c))}{d^{2}}+\frac{b^{2} (\cdots}{\cdots}}{d}$ |
| default | $\frac{-a^{2} \cos \left(d x+c\right)+\frac{2 a b c \cos \left(d x+c\right)}{d}+\frac{2 a b (\sin (d x+c)-\cos (d x+c) (d x+c))}{d}-\frac{b^{2} c^{2} \cos \left(d x+c\right)}{d^{2}}-\frac{2 b^{2} c (\sin (d x+c)-\cos (d x+c) (d x+c))}{d^{2}}+\frac{b^{2} (\cdots}{\cdots}}{d}$ |
| meijerg | $\frac{4 b^{2} \sqrt{\pi}\, \sin \left(c \right) \left(\frac{x \left(d^{2}\right)^{\frac{3}{2}} \cos \left(d x \right)}{2 \sqrt{\pi}\, d^{2}}-\frac{\left(d^{2}\right)^{\frac{3}{2}} \left(-\frac{3 d^{2} x^{2}}{2}+3\right) \sin \left(d x \right)}{6 \sqrt{\pi}\, d^{3}}\right)}{d^{2} \sqrt{d^{2}}}+\frac{4 b^{2} \sqrt{\pi}\, \cos \left(c \right) \left(-\frac{1}{2 \sqrt{\pi}}+\frac{\left(-\frac{d^{2} x^{2}}{2}+1\right) \cos \left(d x \right)}{2 \sqrt{\pi}}+\frac{d x \sin (d \cdots}{2 \sqrt{\pi}} \cdots\right.}{d^{3}}$ |

input
```
int((b*x+a)^2*sin(d*x+c),x,method=_RETURNVERBOSE)
```

output
```
-(b^2*d^2*x^2+2*a*b*d^2*x+a^2*d^2-2*b^2)/d^3*cos(d*x+c)+2*b*(b*x+a)*sin(d*
x+c)/d^2
```

### 3.12.5 Fricas [A] (verification not implemented)

Time = 0.26 (sec) , antiderivative size = 63, normalized size of antiderivative = 1.26

$$\int (a+bx)^2 \sin(c+dx)\,dx = -\frac{\left(b^2d^2x^2+2\,abd^2x+a^2d^2-2\,b^2\right)\cos\left(dx+c\right)-2\left(b^2dx+abd\right)\sin\left(dx+c\right)}{d^3}$$

input
```
integrate((b*x+a)^2*sin(d*x+c),x, algorithm="fricas")
```

output
```
-((b^2*d^2*x^2 + 2*a*b*d^2*x + a^2*d^2 - 2*b^2)*cos(d*x + c) - 2*(b^2*d*x
+ a*b*d)*sin(d*x + c))/d^3
```

### 3.12.6 Sympy [B] (verification not implemented)

Leaf count of result is larger than twice the leaf count of optimal. 112 vs. 2(48) = 96.

Time = 0.20 (sec) , antiderivative size = 112, normalized size of antiderivative = 2.24

$$\int (a+bx)^2 \sin(c+dx)\,dx$$
$$= \begin{cases} -\frac{a^2\cos(c+dx)}{d} - \frac{2abx\cos(c+dx)}{d} + \frac{2ab\sin(c+dx)}{d^2} - \frac{b^2x^2\cos(c+dx)}{d} + \frac{2b^2x\sin(c+dx)}{d^2} + \frac{2b^2\cos(c+dx)}{d^3} & \text{for } d \neq 0 \\ \left(a^2x + abx^2 + \frac{b^2x^3}{3}\right)\sin(c) & \text{otherwise} \end{cases}$$

input
```
integrate((b*x+a)**2*sin(d*x+c),x)
```

output
```
Piecewise((-a**2*cos(c + d*x)/d - 2*a*b*x*cos(c + d*x)/d + 2*a*b*sin(c + d
*x)/d**2 - b**2*x**2*cos(c + d*x)/d + 2*b**2*x*sin(c + d*x)/d**2 + 2*b**2*
cos(c + d*x)/d**3, Ne(d, 0)), ((a**2*x + a*b*x**2 + b**2*x**3/3)*sin(c), T
rue))
```

### 3.12.7 Maxima [B] (verification not implemented)

Leaf count of result is larger than twice the leaf count of optimal. 141 vs. 2(50) = 100.

Time = 0.19 (sec) , antiderivative size = 141, normalized size of antiderivative = 2.82

$$\int (a+bx)^2 \sin(c+dx)\,dx =$$
$$-\frac{a^2\cos(dx+c) + \frac{b^2c^2\cos(dx+c)}{d^2} - \frac{2\,abc\cos(dx+c)}{d} - \frac{2\,((dx+c)\cos(dx+c)-\sin(dx+c))b^2c}{d^2} + \frac{2\,((dx+c)\cos(dx+c)-\sin(dx+c))ab}{d}}{d}$$

input
```
integrate((b*x+a)^2*sin(d*x+c),x, algorithm="maxima")
```

output
```
-(a^2*cos(d*x + c) + b^2*c^2*cos(d*x + c)/d^2 - 2*a*b*c*cos(d*x + c)/d - 2
*((d*x + c)*cos(d*x + c) - sin(d*x + c))*b^2*c/d^2 + 2*((d*x + c)*cos(d*x
+ c) - sin(d*x + c))*a*b/d + (((d*x + c)^2 - 2)*cos(d*x + c) - 2*(d*x + c)
*sin(d*x + c))*b^2/d^2)/d
```

### 3.12.8 Giac [A] (verification not implemented)

Time = 0.28 (sec) , antiderivative size = 65, normalized size of antiderivative = 1.30

$$\int (a+bx)^2 \sin(c+dx)\,dx = -\frac{(b^2d^2x^2 + 2\,abd^2x + a^2d^2 - 2\,b^2)\cos(dx+c)}{d^3} + \frac{2\,(b^2dx + abd)\sin(dx+c)}{d^3}$$

input
```
integrate((b*x+a)^2*sin(d*x+c),x, algorithm="giac")
```

output
```
-(b^2*d^2*x^2 + 2*a*b*d^2*x + a^2*d^2 - 2*b^2)*cos(d*x + c)/d^3 + 2*(b^2*d
*x + a*b*d)*sin(d*x + c)/d^3
```

### 3.12.9 Mupad [B] (verification not implemented)

Time = 5.93 (sec) , antiderivative size = 84, normalized size of antiderivative = 1.68

$$\int (a+bx)^2 \sin(c+dx)\,dx = \frac{\cos(c+d\,x)\,(2\,b^2 - a^2\,d^2)}{d^3} - \frac{b^2\,x^2\,\cos(c+d\,x)}{d} + \frac{2\,a\,b\,\sin(c+d\,x)}{d^2} + \frac{2\,b^2\,x\,\sin(c+d\,x)}{d^2} - \frac{2\,a\,b\,x\,\cos(c+d\,x)}{d}$$

input
```
int(sin(c + d*x)*(a + b*x)^2,x)
```

output
```
(cos(c + d*x)*(2*b^2 - a^2*d^2))/d^3 - (b^2*x^2*cos(c + d*x))/d + (2*a*b*s
in(c + d*x))/d^2 + (2*b^2*x*sin(c + d*x))/d^2 - (2*a*b*x*cos(c + d*x))/d
```

# 3.13 $\int \frac{(a+bx)^2 \sin(c+dx)}{x} \, dx$



## 3.13.1 Optimal result

Integrand size = 17, antiderivative size = 62

$$\int \frac{(a+bx)^2 \sin(c+dx)}{x} \, dx = -\frac{2ab\cos(c+dx)}{d} - \frac{b^2x\cos(c+dx)}{d} + a^2 \operatorname{CosIntegral}(dx)\sin(c) + \frac{b^2\sin(c+dx)}{d^2} + a^2\cos(c)\operatorname{Si}(dx)$$

output
```
-2*a*b*cos(d*x+c)/d-b^2*x*cos(d*x+c)/d+a^2*cos(c)*Si(d*x)+a^2*Ci(d*x)*sin(
c)+b^2*sin(d*x+c)/d^2
```

## 3.13.2 Mathematica [A] (verified)

Time = 0.20 (sec) , antiderivative size = 51, normalized size of antiderivative = 0.82

$$\int \frac{(a+bx)^2 \sin(c+dx)}{x} \, dx = a^2 \operatorname{CosIntegral}(dx)\sin(c) + \frac{b(-d(2a+bx)\cos(c+dx) + b\sin(c+dx))}{d^2} + a^2\cos(c)\operatorname{Si}(dx)$$

input
```
Integrate[((a + b*x)^2*Sin[c + d*x])/x,x]
```

output
```
a^2*CosIntegral[d*x]*Sin[c] + (b*(-(d*(2*a + b*x)*Cos[c + d*x]) + b*Sin[c
+ d*x]))/d^2 + a^2*Cos[c]*SinIntegral[d*x]
```

### 3.13.3 Rubi [A] (verified)

Time = 0.35 (sec) , antiderivative size = 62, normalized size of antiderivative = 1.00, number of steps used = 2, number of rules used = 2, $\frac{\text{number of rules}}{\text{integrand size}}$ = 0.118, Rules used = {7293, 2009}

Below are the steps used by Rubi to obtain the solution. The rule number used for the transformation is given above next to the arrow. The rules definitions used are listed below.

$$\int \frac{(a+bx)^2\sin(c+dx)}{x}\,dx$$

$$\Big\downarrow \ 7293$$

$$\int \left(\frac{a^2\sin(c+dx)}{x}+2ab\sin(c+dx)+b^2x\sin(c+dx)\right)dx$$

$$\Big\downarrow \ 2009$$

$$a^2\sin(c)\,\text{CosIntegral}(dx)+a^2\cos(c)\text{Si}(dx)-\frac{2ab\cos(c+dx)}{d}+\frac{b^2\sin(c+dx)}{d^2}-\frac{b^2x\cos(c+dx)}{d}$$

input
```
Int[((a + b*x)^2*Sin[c + d*x])/x,x]
```

output
```
(-2*a*b*Cos[c + d*x])/d - (b^2*x*Cos[c + d*x])/d + a^2*CosIntegral[d*x]*Si
n[c] + (b^2*Sin[c + d*x])/d^2 + a^2*Cos[c]*SinIntegral[d*x]
```

#### 3.13.3.1 Defintions of rubi rules used

rule 2009
```
Int[u_, x_Symbol] :> Simp[IntSum[u, x], x] /; SumQ[u]
```

rule 7293
```
Int[u_, x_Symbol] :> With[{v = ExpandIntegrand[u, x]}, Int[v, x] /; SumQ[v]
]
```

### 3.13.4 Maple [A] (verified)

Time = 0.26 (sec) , antiderivative size = 79, normalized size of antiderivative = 1.27

| method | result |
|---|---|
| derivativedivides | $a^2(\mathrm{Si}(dx)\cos(c)+\mathrm{Ci}(dx)\sin(c))-\frac{2ab\cos(dx+c)}{d}+\frac{2b^2c\cos(dx+c)}{d^2}+\frac{(c+1)b^2(\sin(dx+c)-\cos(dx+}{d^2}$ |
| default | $a^2(\mathrm{Si}(dx)\cos(c)+\mathrm{Ci}(dx)\sin(c))-\frac{2ab\cos(dx+c)}{d}+\frac{2b^2c\cos(dx+c)}{d^2}+\frac{(c+1)b^2(\sin(dx+c)-\cos(dx+}{d^2}$ |
| risch | $-\frac{e^{-ic}\pi\ \mathrm{csgn}(dx)a^2}{2}-\frac{ie^{-ic}\,\mathrm{Ei}_1(-idx)a^2}{2}+\frac{ia^2e^{ic}\,\mathrm{Ei}_1(-idx)}{2}+e^{-ic}\,\mathrm{Si}(dx)\,a^2-\frac{b^2x\cos(dx+c)}{d}-\frac{2ab\cos}{d}$ |
| meijerg | $\frac{2b^2\sqrt{\pi}\,\sin(c)\left(-\frac{1}{2\sqrt{\pi}}+\frac{\cos(dx)}{2\sqrt{\pi}}+\frac{dx\sin(dx)}{2\sqrt{\pi}}\right)}{d^2}+\frac{2b^2\sqrt{\pi}\,\cos(c)\left(-\frac{dx\cos(dx)}{2\sqrt{\pi}}+\frac{\sin(dx)}{2\sqrt{\pi}}\right)}{d^2}+\frac{2ab\sin(c)\sin(dx)}{d}+\frac{2ab\sqrt{\pi}}{}$ |

input
```
int((b*x+a)^2*sin(d*x+c)/x,x,method=_RETURNVERBOSE)
```

output
```
a^2*(Si(d*x)*cos(c)+Ci(d*x)*sin(c))-2*a*b*cos(d*x+c)/d+2/d^2*b^2*c*cos(d*x
+c)+(c+1)/d^2*b^2*(sin(d*x+c)-cos(d*x+c)*(d*x+c))
```

### 3.13.5 Fricas [A] (verification not implemented)

Time = 0.28 (sec) , antiderivative size = 61, normalized size of antiderivative = 0.98

$$\int \frac{(a+bx)^2\sin(c+dx)}{x}\,dx = \frac{a^2d^2\,\mathrm{Ci}(dx)\sin(c)+a^2d^2\cos(c)\,\mathrm{Si}(dx)+b^2\sin(dx+c)-(b^2dx+2\,abd)\cos(dx+c)}{d^2}$$

input
```
integrate((b*x+a)^2*sin(d*x+c)/x,x, algorithm="fricas")
```

output
```
(a^2*d^2*cos_integral(d*x)*sin(c) + a^2*d^2*cos(c)*sin_integral(d*x) + b^2
*sin(d*x + c) - (b^2*d*x + 2*a*b*d)*cos(d*x + c))/d^2
```

### 3.13.6 Sympy [A] (verification not implemented)

Time = 1.41 (sec) , antiderivative size = 92, normalized size of antiderivative = 1.48

$$\int \frac{(a+bx)^2\sin(c+dx)}{x}\,dx = a^2\sin{(c)}\operatorname{Ci}{(dx)} + a^2\cos{(c)}\operatorname{Si}{(dx)} + 2ab\left(\begin{cases} x\sin{(c)} & \text{for}\: d=0 \\ -\frac{\cos{(c+dx)}}{d} & \text{otherwise} \end{cases}\right) + b^2x\left(\begin{cases} x\sin{(c)} & \text{for}\: d=0 \\ -\frac{\cos{(c+dx)}}{d} & \text{otherwise} \end{cases}\right) - b^2\left(\begin{cases} \frac{x^2\sin{(c)}}{2} & \text{for}\: d=0 \\ -\frac{\begin{cases} \frac{\sin{(c+dx)}}{d} & \text{for}\: d\neq 0 \\ x\cos{(c)} & \text{otherwise} \end{cases}}{d} & \text{otherwise} \end{cases}\right)$$

input
```
integrate((b*x+a)**2*sin(d*x+c)/x,x)
```

output
```
a**2*sin(c)*Ci(d*x) + a**2*cos(c)*Si(d*x) + 2*a*b*Piecewise((x*sin(c), Eq(
d, 0)), (-cos(c + d*x)/d, True)) + b**2*x*Piecewise((x*sin(c), Eq(d, 0)),
(-cos(c + d*x)/d, True)) - b**2*Piecewise((x**2*sin(c)/2, Eq(d, 0)), (-Pie
cewise((sin(c + d*x)/d, Ne(d, 0)), (x*cos(c), True))/d, True))
```

### 3.13.7 Maxima [C] (verification not implemented)

Result contains complex when optimal does not.

Time = 0.46 (sec) , antiderivative size = 80, normalized size of antiderivative = 1.29

$$\int \frac{(a+bx)^2\sin(c+dx)}{x}\,dx = \frac{(a^2(-i\operatorname{Ei}(i\,dx)+i\operatorname{Ei}(-i\,dx))\cos{(c)} + a^2(\operatorname{Ei}(i\,dx)+\operatorname{Ei}(-i\,dx))\sin{(c)})d^2 + 2\,b^2\sin{(dx+c)} - 2\,(b^2dx+}{2\,d^2}$$

input
```
integrate((b*x+a)^2*sin(d*x+c)/x,x, algorithm="maxima")
```

output
```
1/2*((a^2*(-I*Ei(I*d*x) + I*Ei(-I*d*x))*cos(c) + a^2*(Ei(I*d*x) + Ei(-I*d*
x))*sin(c))*d^2 + 2*b^2*sin(d*x + c) - 2*(b^2*d*x + 2*a*b*d)*cos(d*x + c))
/d^2
```

### 3.13.8 Giac [C] (verification not implemented)

Result contains higher order function than in optimal. Order 9 vs. order 4.

Time = 0.28 (sec) , antiderivative size = 551, normalized size of antiderivative = 8.89

$$\int \frac{(a+bx)^2\sin(c+dx)}{x}\,dx =$$

$$-\frac{a^2d^2\Im(\mathrm{Ci}\,(dx))\tan\left(\frac{1}{2}\,dx+\frac{1}{2}\,c\right)^2\tan\left(\frac{1}{2}\,c\right)^2 - a^2d^2\Im(\mathrm{Ci}\,(-dx))\tan\left(\frac{1}{2}\,dx+\frac{1}{2}\,c\right)^2\tan\left(\frac{1}{2}\,c\right)^2 + 2\,a^2d^2\,\mathrm{Si}\,(}{}$$

input
```
integrate((b*x+a)^2*sin(d*x+c)/x,x, algorithm="giac")
```

output
```
-1/2*(a^2*d^2*imag_part(cos_integral(d*x))*tan(1/2*d*x + 1/2*c)^2*tan(1/2*
c)^2 - a^2*d^2*imag_part(cos_integral(-d*x))*tan(1/2*d*x + 1/2*c)^2*tan(1/
2*c)^2 + 2*a^2*d^2*sin_integral(d*x)*tan(1/2*d*x + 1/2*c)^2*tan(1/2*c)^2 -
 2*a^2*d^2*real_part(cos_integral(d*x))*tan(1/2*d*x + 1/2*c)^2*tan(1/2*c)
- 2*a^2*d^2*real_part(cos_integral(-d*x))*tan(1/2*d*x + 1/2*c)^2*tan(1/2*c
) - 2*b^2*d*x*tan(1/2*d*x + 1/2*c)^2*tan(1/2*c)^2 - a^2*d^2*imag_part(cos_
integral(d*x))*tan(1/2*d*x + 1/2*c)^2 + a^2*d^2*imag_part(cos_integral(-d*
x))*tan(1/2*d*x + 1/2*c)^2 - 2*a^2*d^2*sin_integral(d*x)*tan(1/2*d*x + 1/2
*c)^2 + a^2*d^2*imag_part(cos_integral(d*x))*tan(1/2*c)^2 - a^2*d^2*imag_p
art(cos_integral(-d*x))*tan(1/2*c)^2 + 2*a^2*d^2*sin_integral(d*x)*tan(1/2
*c)^2 - 4*a*b*d*tan(1/2*d*x + 1/2*c)^2*tan(1/2*c)^2 - 2*b^2*d*x*tan(1/2*d*
x + 1/2*c)^2 - 2*a^2*d^2*real_part(cos_integral(d*x))*tan(1/2*c) - 2*a^2*d
^2*real_part(cos_integral(-d*x))*tan(1/2*c) + 2*b^2*d*x*tan(1/2*c)^2 - a^2
*d^2*imag_part(cos_integral(d*x)) + a^2*d^2*imag_part(cos_integral(-d*x))
- 2*a^2*d^2*sin_integral(d*x) - 4*a*b*d*tan(1/2*d*x + 1/2*c)^2 + 4*a*b*d*t
an(1/2*c)^2 - 4*b^2*tan(1/2*d*x + 1/2*c)*tan(1/2*c)^2 + 2*b^2*d*x + 4*a*b*
d - 4*b^2*tan(1/2*d*x + 1/2*c))/(d^2*tan(1/2*d*x + 1/2*c)^2*tan(1/2*c)^2 +
 d^2*tan(1/2*d*x + 1/2*c)^2 + d^2*tan(1/2*c)^2 + d^2)
```

### 3.13.9 Mupad [F(-1)]

Timed out.

$$\int \frac{(a+bx)^2\sin(c+dx)}{x}\,dx = b^2\cos(c)\left(\frac{\sin(d\,x)}{d^2}-\frac{x\cos(d\,x)}{d}\right) + b^2\sin(c)\left(\frac{\cos(d\,x)}{d^2}+\frac{x\sin(d\,x)}{d}\right) + a^2\operatorname{cosint}(d\,x)\sin(c) + a^2\operatorname{sinint}(d\,x)\cos(c) - \frac{2\,a\,b\cos(d\,x)\cos(c)}{d} + \frac{2\,a\,b\sin(d\,x)\sin(c)}{d}$$

input
```
int((sin(c + d*x)*(a + b*x)^2)/x,x)
```

output
```
b^2*cos(c)*(sin(d*x)/d^2 - (x*cos(d*x))/d) + b^2*sin(c)*(cos(d*x)/d^2 + (x
*sin(d*x))/d) + a^2*cosint(d*x)*sin(c) + a^2*sinint(d*x)*cos(c) - (2*a*b*c
os(d*x)*cos(c))/d + (2*a*b*sin(d*x)*sin(c))/d
```

# 3.14 $\int \frac{(a+bx)^2 \sin(c+dx)}{x^2} \, dx$



## 3.14.1 Optimal result

Integrand size = 17, antiderivative size = 72

$$\int \frac{(a+bx)^2 \sin(c+dx)}{x^2} \, dx = -\frac{b^2 \cos(c+dx)}{d} + a^2 d \cos(c) \operatorname{CosIntegral}(dx) + 2ab \operatorname{CosIntegral}(dx) \sin(c) - \frac{a^2 \sin(c+dx)}{x} + 2ab \cos(c) \operatorname{Si}(dx) - a^2 d \sin(c) \operatorname{Si}(dx)$$

output
```
a^2*d*Ci(d*x)*cos(c)-b^2*cos(d*x+c)/d+2*a*b*cos(c)*Si(d*x)+2*a*b*Ci(d*x)*s
in(c)-a^2*d*Si(d*x)*sin(c)-a^2*sin(d*x+c)/x
```

## 3.14.2 Mathematica [A] (verified)

Time = 0.16 (sec) , antiderivative size = 64, normalized size of antiderivative = 0.89

$$\int \frac{(a+bx)^2 \sin(c+dx)}{x^2} \, dx = -\frac{b^2 \cos(c+dx)}{d} + a \operatorname{CosIntegral}(dx)(ad \cos(c) + 2b \sin(c)) - \frac{a^2 \sin(c+dx)}{x} - a(-2b \cos(c) + ad \sin(c)) \operatorname{Si}(dx)$$

input
```
Integrate[((a + b*x)^2*Sin[c + d*x])/x^2,x]
```

output
```
-((b^2*Cos[c + d*x])/d) + a*CosIntegral[d*x]*(a*d*Cos[c] + 2*b*Sin[c]) - (
a^2*Sin[c + d*x])/x - a*(-2*b*Cos[c] + a*d*Sin[c])*SinIntegral[d*x]
```

### 3.14.3 Rubi [A] (verified)

Time = 0.41 (sec) , antiderivative size = 72, normalized size of antiderivative = 1.00, number of steps used = 2, number of rules used = 2, $\frac{\text{number of rules}}{\text{integrand size}} = 0.118$, Rules used = {7293, 2009}

Below are the steps used by Rubi to obtain the solution. The rule number used for the transformation is given above next to the arrow. The rules definitions used are listed below.

$$\int \frac{(a+bx)^2\sin(c+dx)}{x^2}\,dx$$

$$\Big\downarrow \text{7293}$$

$$\int \left(\frac{a^2\sin(c+dx)}{x^2}+\frac{2ab\sin(c+dx)}{x}+b^2\sin(c+dx)\right)dx$$

$$\Big\downarrow \text{2009}$$

$$a^2 d\cos(c)\,\text{CosIntegral}(dx)-a^2 d\sin(c)\text{Si}(dx)-\frac{a^2\sin(c+dx)}{x}+2ab\sin(c)\,\text{CosIntegral}(dx)+2ab\cos(c)\text{Si}(dx)-\frac{b^2\cos(c+dx)}{d}$$

input
```
Int[((a + b*x)^2*Sin[c + d*x])/x^2,x]
```

output
```
-((b^2*Cos[c + d*x])/d) + a^2*d*Cos[c]*CosIntegral[d*x] + 2*a*b*CosIntegra
l[d*x]*Sin[c] - (a^2*Sin[c + d*x])/x + 2*a*b*Cos[c]*SinIntegral[d*x] - a^2
*d*Sin[c]*SinIntegral[d*x]
```

#### 3.14.3.1 Defintions of rubi rules used

rule 2009
```
Int[u_, x_Symbol] :> Simp[IntSum[u, x], x] /; SumQ[u]
```

rule 7293
```
Int[u_, x_Symbol] :> With[{v = ExpandIntegrand[u, x]}, Int[v, x] /; SumQ[v]
]
```

### 3.14.4 Maple [A] (verified)

Time = 0.25 (sec) , antiderivative size = 74, normalized size of antiderivative = 1.03

| method | result |
|---|---|
| derivativedivides | $d\left(a^{2}\left(-\frac{\sin(dx+c)}{dx}-\operatorname{Si}(dx)\sin(c)+\operatorname{Ci}(dx)\cos(c)\right)+\frac{2ab(\operatorname{Si}(dx)\cos(c)+\operatorname{Ci}(dx)\sin(c))}{d}-\frac{b^{2}\cos(d}{d^{2}}\right.$ |
| default | $d\left(a^{2}\left(-\frac{\sin(dx+c)}{dx}-\operatorname{Si}(dx)\sin(c)+\operatorname{Ci}(dx)\cos(c)\right)+\frac{2ab(\operatorname{Si}(dx)\cos(c)+\operatorname{Ci}(dx)\sin(c))}{d}-\frac{b^{2}\cos(d}{d^{2}}\right.$ |
| risch | $i\cos(c)\operatorname{Ei}_{1}(-idx)\,ab-\frac{d\cos(c)a^{2}\operatorname{Ei}_{1}(-idx)}{2}-i\cos(c)\operatorname{Ei}_{1}(idx)\,ab-\frac{d\cos(c)a^{2}\operatorname{Ei}_{1}(idx)}{2}-\sin($ |
| meijerg | $\frac{b^{2}\sin(c)\sin(dx)}{d}+\frac{b^{2}\sqrt{\pi}\cos(c)\left(\frac{1}{\sqrt{\pi}}-\frac{\cos(dx)}{\sqrt{\pi}}\right)}{d}+ab\sqrt{\pi}\sin(c)\left(\frac{2\gamma+2\ln(x)+\ln(d^{2})}{\sqrt{\pi}}-\frac{2\gamma}{\sqrt{\pi}}-\frac{2\ln(2)}{\sqrt{\pi}}-\frac{2\,\mathrm{l}}{}\right.$ |

input

```
int((b*x+a)^2*sin(d*x+c)/x^2,x,method=_RETURNVERBOSE)
```

output

```
d*(a^2*(-sin(d*x+c)/d/x-Si(d*x)*sin(c)+Ci(d*x)*cos(c))+2/d*a*b*(Si(d*x)*co
s(c)+Ci(d*x)*sin(c))-1/d^2*b^2*cos(d*x+c))
```

### 3.14.5 Fricas [A] (verification not implemented)

Time = 0.28 (sec) , antiderivative size = 84, normalized size of antiderivative = 1.17

$$\int \frac{(a+bx)^2\sin(c+dx)}{x^2}\,dx = -\frac{b^2x\cos(dx+c)+a^2d\sin(dx+c)-(a^2d^2x\operatorname{Ci}(dx)+2\,abdx\operatorname{Si}(dx))\cos(c)+(a^2d^2x\operatorname{Si}(dx)-2\,abdx\,\mathrm{C}}{dx}$$

input

```
integrate((b*x+a)^2*sin(d*x+c)/x^2,x, algorithm="fricas")
```

output

```
-(b^2*x*cos(d*x + c) + a^2*d*sin(d*x + c) - (a^2*d^2*x*cos_integral(d*x) +
 2*a*b*d*x*sin_integral(d*x))*cos(c) + (a^2*d^2*x*sin_integral(d*x) - 2*a*
b*d*x*cos_integral(d*x))*sin(c))/(d*x)
```

### 3.14.6 Sympy [F]

$$\int \frac{(a+bx)^2 \sin(c+dx)}{x^2} \, dx = \int \frac{(a+bx)^2 \sin{(c+dx)}}{x^2} \, dx$$

input
```
integrate((b*x+a)**2*sin(d*x+c)/x**2,x)
```

output
```
Integral((a + b*x)**2*sin(c + d*x)/x**2, x)
```

### 3.14.7 Maxima [C] (verification not implemented)

Result contains complex when optimal does not.

Time = 0.68 (sec) , antiderivative size = 122, normalized size of antiderivative = 1.69

$$\int \frac{(a+bx)^2 \sin(c+dx)}{x^2} \, dx = \frac{((a^2(\Gamma(-1,i\,dx)+\Gamma(-1,-i\,dx))\cos{(c)}-a^2(i\,\Gamma(-1,i\,dx)-i\,\Gamma(-1,-i\,dx))\sin{(c)})d^2+2\,(ab(i\,\Gamma(-1,i\,d}{2\,dx}$$

input
```
integrate((b*x+a)^2*sin(d*x+c)/x^2,x, algorithm="maxima")
```

output
```
1/2*(((a^2*(gamma(-1, I*d*x) + gamma(-1, -I*d*x))*cos(c) - a^2*(I*gamma(-1
, I*d*x) - I*gamma(-1, -I*d*x))*sin(c))*d^2 + 2*(a*b*(I*gamma(-1, I*d*x) -
 I*gamma(-1, -I*d*x))*cos(c) + a*b*(gamma(-1, I*d*x) + gamma(-1, -I*d*x))*
sin(c))*d)*x - 2*(b^2*x + 2*a*b)*cos(d*x + c))/(d*x)
```

### 3.14.8 Giac [C] (verification not implemented)

Result contains higher order function than in optimal. Order 9 vs. order 4.

Time = 0.29 (sec) , antiderivative size = 743, normalized size of antiderivative = 10.32

$$\int \frac{(a+bx)^2 \sin(c+dx)}{x^2} \, dx = \text{Too large to display}$$

input
```
integrate((b*x+a)^2*sin(d*x+c)/x^2,x, algorithm="giac")
```

output
```
-1/2*(a^2*d^2*x*real_part(cos_integral(d*x))*tan(1/2*d*x)^2*tan(1/2*c)^2 +
 a^2*d^2*x*real_part(cos_integral(-d*x))*tan(1/2*d*x)^2*tan(1/2*c)^2 + 2*a
^2*d^2*x*imag_part(cos_integral(d*x))*tan(1/2*d*x)^2*tan(1/2*c) - 2*a^2*d^
2*x*imag_part(cos_integral(-d*x))*tan(1/2*d*x)^2*tan(1/2*c) + 4*a^2*d^2*x*
sin_integral(d*x)*tan(1/2*d*x)^2*tan(1/2*c) + 2*a*b*d*x*imag_part(cos_inte
gral(d*x))*tan(1/2*d*x)^2*tan(1/2*c)^2 - 2*a*b*d*x*imag_part(cos_integral(
-d*x))*tan(1/2*d*x)^2*tan(1/2*c)^2 + 4*a*b*d*x*sin_integral(d*x)*tan(1/2*d
*x)^2*tan(1/2*c)^2 - a^2*d^2*x*real_part(cos_integral(d*x))*tan(1/2*d*x)^2
 - a^2*d^2*x*real_part(cos_integral(-d*x))*tan(1/2*d*x)^2 - 4*a*b*d*x*real
_part(cos_integral(d*x))*tan(1/2*d*x)^2*tan(1/2*c) - 4*a*b*d*x*real_part(c
os_integral(-d*x))*tan(1/2*d*x)^2*tan(1/2*c) + a^2*d^2*x*real_part(cos_int
egral(d*x))*tan(1/2*c)^2 + a^2*d^2*x*real_part(cos_integral(-d*x))*tan(1/2
*c)^2 - 2*a*b*d*x*imag_part(cos_integral(d*x))*tan(1/2*d*x)^2 + 2*a*b*d*x*
imag_part(cos_integral(-d*x))*tan(1/2*d*x)^2 - 4*a*b*d*x*sin_integral(d*x)
*tan(1/2*d*x)^2 + 2*a^2*d^2*x*imag_part(cos_integral(d*x))*tan(1/2*c) - 2*
a^2*d^2*x*imag_part(cos_integral(-d*x))*tan(1/2*c) + 4*a^2*d^2*x*sin_integ
ral(d*x)*tan(1/2*c) + 2*a*b*d*x*imag_part(cos_integral(d*x))*tan(1/2*c)^2
- 2*a*b*d*x*imag_part(cos_integral(-d*x))*tan(1/2*c)^2 + 4*a*b*d*x*sin_int
egral(d*x)*tan(1/2*c)^2 + 2*b^2*x*tan(1/2*d*x)^2*tan(1/2*c)^2 - a^2*d^2*x*
real_part(cos_integral(d*x)) - a^2*d^2*x*real_part(cos_integral(-d*x)) ...
```

### 3.14.9 Mupad [F(-1)]

Timed out.

$$\int \frac{(a+bx)^2\sin(c+dx)}{x^2}\,dx=\int \frac{\sin\left(c+d\,x\right)\,\left(a+b\,x\right)^2}{x^2}\,dx$$

input
```
int((sin(c + d*x)*(a + b*x)^2)/x^2,x)
```

output
```
int((sin(c + d*x)*(a + b*x)^2)/x^2, x)
```

# 3.15 $\int \frac{(a+bx)^2 \sin(c+dx)}{x^3} \, dx$



## 3.15.1 Optimal result

Integrand size = 17, antiderivative size = 121

$$\int \frac{(a+bx)^2 \sin(c+dx)}{x^3} \, dx = -\frac{a^2 d \cos(c+dx)}{2x} + 2abd \cos(c) \operatorname{CosIntegral}(dx) + b^2 \operatorname{CosIntegral}(dx) \sin(c) - \frac{1}{2} a^2 d^2 \operatorname{CosIntegral}(dx) \sin(c) - \frac{a^2 \sin(c+dx)}{2x^2} - \frac{2ab \sin(c+dx)}{x} + b^2 \cos(c) \operatorname{Si}(dx) - \frac{1}{2} a^2 d^2 \cos(c) \operatorname{Si}(dx) - 2abd \sin(c) \operatorname{Si}(dx)$$

output
```
2*a*b*d*Ci(d*x)*cos(c)-1/2*a^2*d*cos(d*x+c)/x+b^2*cos(c)*Si(d*x)-1/2*a^2*d
^2*cos(c)*Si(d*x)+b^2*Ci(d*x)*sin(c)-1/2*a^2*d^2*Ci(d*x)*sin(c)-2*a*b*d*Si
(d*x)*sin(c)-1/2*a^2*sin(d*x+c)/x^2-2*a*b*sin(d*x+c)/x
```

## 3.15.2 Mathematica [A] (verified)

Time = 0.27 (sec) , antiderivative size = 95, normalized size of antiderivative = 0.79

$$\int \frac{(a+bx)^2 \sin(c+dx)}{x^3} \, dx = \frac{1}{2} \left( \operatorname{CosIntegral}(dx) \left(4abd \cos(c) + \left(2b^2 - a^2 d^2\right) \sin(c)\right) - \frac{a(adx \cos(c+dx) + (a+4bx) \sin(c+dx))}{x^2} + \left(\left(2b^2 - a^2 d^2\right) \cos(c) - 4abd \sin(c)\right) \operatorname{Si}(dx) \right)$$

input
```
Integrate[((a + b*x)^2*Sin[c + d*x])/x^3,x]
```

output
```
(CosIntegral[d*x]*(4*a*b*d*Cos[c] + (2*b^2 - a^2*d^2)*Sin[c]) - (a*(a*d*x*
Cos[c + d*x] + (a + 4*b*x)*Sin[c + d*x]))/x^2 + ((2*b^2 - a^2*d^2)*Cos[c]
- 4*a*b*d*Sin[c])*SinIntegral[d*x])/2
```

### 3.15.3 Rubi [A] (verified)

Time = 0.51 (sec) , antiderivative size = 121, normalized size of antiderivative = 1.00, number of steps used = 2, number of rules used = 2, $\frac{\text{number of rules}}{\text{integrand size}}$ = 0.118, Rules used = {7293, 2009}

Below are the steps used by Rubi to obtain the solution. The rule number used for the transformation is given above next to the arrow. The rules definitions used are listed below.

$$\int \frac{(a+bx)^2\sin(c+dx)}{x^3}\,dx$$
$$\Big\downarrow \text{7293}$$
$$\int \left(\frac{a^2\sin(c+dx)}{x^3}+\frac{2ab\sin(c+dx)}{x^2}+\frac{b^2\sin(c+dx)}{x}\right)dx$$
$$\Big\downarrow \text{2009}$$
$$-\frac{1}{2}a^2d^2\sin(c)\,\text{CosIntegral}(dx)-\frac{1}{2}a^2d^2\cos(c)\text{Si}(dx)-\frac{a^2\sin(c+dx)}{2x^2}-\frac{a^2d\cos(c+dx)}{2x}+2abd\cos(c)\,\text{CosIntegral}(dx)-2abd\sin(c)\text{Si}(dx)-\frac{2ab\sin(c+dx)}{x}+b^2\sin(c)\,\text{CosIntegral}(dx)+b^2\cos(c)\text{Si}(dx)$$

input
```
Int[((a + b*x)^2*Sin[c + d*x])/x^3,x]
```

output
```
-1/2*(a^2*d*Cos[c + d*x])/x + 2*a*b*d*Cos[c]*CosIntegral[d*x] + b^2*CosInt
egral[d*x]*Sin[c] - (a^2*d^2*CosIntegral[d*x]*Sin[c])/2 - (a^2*Sin[c + d*x
])/(2*x^2) - (2*a*b*Sin[c + d*x])/x + b^2*Cos[c]*SinIntegral[d*x] - (a^2*d
^2*Cos[c]*SinIntegral[d*x])/2 - 2*a*b*d*Sin[c]*SinIntegral[d*x]
```

#### 3.15.3.1 Defintions of rubi rules used

rule 2009
```
Int[u_, x_Symbol] :> Simp[IntSum[u, x], x] /; SumQ[u]
```

rule 7293
```
Int[u_, x_Symbol] :> With[{v = ExpandIntegrand[u, x]}, Int[v, x] /; SumQ[v]
]
```

### 3.15.4 Maple [A] (verified)

Time = 0.26 (sec) , antiderivative size = 114, normalized size of antiderivative = 0.94

| method | result |
|---|---|
| derivativedivides | $d^2\left(a^2\left(-\frac{\sin(dx+c)}{2d^2x^2}-\frac{\cos(dx+c)}{2dx}-\frac{\mathrm{Si}(dx)\cos(c)}{2}-\frac{\mathrm{Ci}(dx)\sin(c)}{2}\right)+\frac{2ab\left(-\frac{\sin(dx+c)}{dx}-\mathrm{Si}(dx)\sin(c)+\mathrm{Ci}(dx)\right.}{d}\right.$ |
| default | $d^2\left(a^2\left(-\frac{\sin(dx+c)}{2d^2x^2}-\frac{\cos(dx+c)}{2dx}-\frac{\mathrm{Si}(dx)\cos(c)}{2}-\frac{\mathrm{Ci}(dx)\sin(c)}{2}\right)+\frac{2ab\left(-\frac{\sin(dx+c)}{dx}-\mathrm{Si}(dx)\sin(c)+\mathrm{Ci}(dx)\right.}{d}\right.$ |
| risch | $-\mathrm{Ei}_1(-idx)\cos(c)\,abd-\cos(c)\,\mathrm{Ei}_1(idx)\,abd-\frac{i\,\mathrm{Ei}_1(-idx)\cos(c)a^2d^2}{4}+\frac{i\cos(c)\,\mathrm{Ei}_1(idx)a^2d^2}{4}+$ |
| meijerg | $\frac{b^2\sqrt{\pi}\sin(c)\left(\frac{2\gamma+2\ln(x)+\ln(d^2)}{\sqrt{\pi}}-\frac{2\gamma}{\sqrt{\pi}}-\frac{2\ln(2)}{\sqrt{\pi}}-\frac{2\ln\left(\frac{dx}{2}\right)}{\sqrt{\pi}}+\frac{2\,\mathrm{Ci}(dx)}{\sqrt{\pi}}\right)}{2}+b^2\cos(c)\,\mathrm{Si}(dx)+\frac{d^2ab\sqrt{\pi}\sin(c)\left(-\frac{4}{}\right.}{}$ |

input
```
int((b*x+a)^2*sin(d*x+c)/x^3,x,method=_RETURNVERBOSE)
```

output
```
d^2*(a^2*(-1/2*sin(d*x+c)/d^2/x^2-1/2*cos(d*x+c)/d/x-1/2*Si(d*x)*cos(c)-1/
2*Ci(d*x)*sin(c))+2/d*a*b*(-sin(d*x+c)/d/x-Si(d*x)*sin(c)+Ci(d*x)*cos(c))+
1/d^2*b^2*(Si(d*x)*cos(c)+Ci(d*x)*sin(c)))
```

### 3.15.5 Fricas [A] (verification not implemented)

Time = 0.26 (sec) , antiderivative size = 110, normalized size of antiderivative = 0.91

$$\int \frac{(a+bx)^2\sin(c+dx)}{x^3}\,dx = -\frac{a^2dx\cos(dx+c)-(4\,abdx^2\,\mathrm{Ci}(dx)-(a^2d^2-2\,b^2)x^2\,\mathrm{Si}(dx))\cos(c)+(4\,abx+a^2)\sin(dx+c)+(4\,a}{2\,x^2}$$

input
```
integrate((b*x+a)^2*sin(d*x+c)/x^3,x, algorithm="fricas")
```

output
```
-1/2*(a^2*d*x*cos(d*x + c) - (4*a*b*d*x^2*cos_integral(d*x) - (a^2*d^2 - 2
*b^2)*x^2*sin_integral(d*x))*cos(c) + (4*a*b*x + a^2)*sin(d*x + c) + (4*a*
b*d*x^2*sin_integral(d*x) + (a^2*d^2 - 2*b^2)*x^2*cos_integral(d*x))*sin(c
))/x^2
```

### 3.15.6 Sympy [F]

$$\int \frac{(a+bx)^2 \sin(c+dx)}{x^3} dx = \int \frac{(a+bx)^2 \sin(c+dx)}{x^3} dx$$

input
```
integrate((b*x+a)**2*sin(d*x+c)/x**3,x)
```

output
```
Integral((a + b*x)**2*sin(c + d*x)/x**3, x)
```

### 3.15.7 Maxima [C] (verification not implemented)

Result contains complex when optimal does not.

Time = 1.11 (sec) , antiderivative size = 189, normalized size of antiderivative = 1.56

$$\int \frac{(a+bx)^2 \sin(c+dx)}{x^3} dx = -\frac{((a^2(-i\Gamma(-2,i\,dx)+i\,\Gamma(-2,-i\,dx))\cos(c)-a^2(\Gamma(-2,i\,dx)+\Gamma(-2,-i\,dx))\sin(c))d^4+4\,(ab(\Gamma(-2,$$

input
```
integrate((b*x+a)^2*sin(d*x+c)/x^3,x, algorithm="maxima")
```

output
```
-1/2*(((a^2*(-I*gamma(-2, I*d*x) + I*gamma(-2, -I*d*x))*cos(c) - a^2*(gamm
a(-2, I*d*x) + gamma(-2, -I*d*x))*sin(c))*d^4 + 4*(a*b*(gamma(-2, I*d*x) +
 gamma(-2, -I*d*x))*cos(c) - a*b*(I*gamma(-2, I*d*x) - I*gamma(-2, -I*d*x)
)*sin(c))*d^3 - 2*(b^2*(-I*gamma(-2, I*d*x) + I*gamma(-2, -I*d*x))*cos(c)
- b^2*(gamma(-2, I*d*x) + gamma(-2, -I*d*x))*sin(c))*d^2)*x^2 + 2*b^2*sin(
d*x + c) + 2*(b^2*d*x + 2*a*b*d)*cos(d*x + c))/(d^2*x^2)
```

### 3.15.8 Giac [C] (verification not implemented)

Result contains higher order function than in optimal. Order 9 vs. order 4.

Time = 0.30 (sec) , antiderivative size = 1182, normalized size of antiderivative = 9.77

$$\int \frac{(a+bx)^2\sin(c+dx)}{x^3}\,dx = \text{Too large to display}$$

input
```
integrate((b*x+a)^2*sin(d*x+c)/x^3,x, algorithm="giac")
```

output
```
1/4*(a^2*d^2*x^2*imag_part(cos_integral(d*x))*tan(1/2*d*x)^2*tan(1/2*c)^2
- a^2*d^2*x^2*imag_part(cos_integral(-d*x))*tan(1/2*d*x)^2*tan(1/2*c)^2 +
2*a^2*d^2*x^2*sin_integral(d*x)*tan(1/2*d*x)^2*tan(1/2*c)^2 - 2*a^2*d^2*x^
2*real_part(cos_integral(d*x))*tan(1/2*d*x)^2*tan(1/2*c) - 2*a^2*d^2*x^2*r
eal_part(cos_integral(-d*x))*tan(1/2*d*x)^2*tan(1/2*c) - 4*a*b*d*x^2*real_
part(cos_integral(d*x))*tan(1/2*d*x)^2*tan(1/2*c)^2 - 4*a*b*d*x^2*real_par
t(cos_integral(-d*x))*tan(1/2*d*x)^2*tan(1/2*c)^2 - a^2*d^2*x^2*imag_part(
cos_integral(d*x))*tan(1/2*d*x)^2 + a^2*d^2*x^2*imag_part(cos_integral(-d*
x))*tan(1/2*d*x)^2 - 2*a^2*d^2*x^2*sin_integral(d*x)*tan(1/2*d*x)^2 - 8*a*
b*d*x^2*imag_part(cos_integral(d*x))*tan(1/2*d*x)^2*tan(1/2*c) + 8*a*b*d*x
^2*imag_part(cos_integral(-d*x))*tan(1/2*d*x)^2*tan(1/2*c) - 16*a*b*d*x^2*
sin_integral(d*x)*tan(1/2*d*x)^2*tan(1/2*c) + a^2*d^2*x^2*imag_part(cos_in
tegral(d*x))*tan(1/2*c)^2 - a^2*d^2*x^2*imag_part(cos_integral(-d*x))*tan(
1/2*c)^2 + 2*a^2*d^2*x^2*sin_integral(d*x)*tan(1/2*c)^2 - 2*b^2*x^2*imag_p
art(cos_integral(d*x))*tan(1/2*d*x)^2*tan(1/2*c)^2 + 2*b^2*x^2*imag_part(c
os_integral(-d*x))*tan(1/2*d*x)^2*tan(1/2*c)^2 - 4*b^2*x^2*sin_integral(d*
x)*tan(1/2*d*x)^2*tan(1/2*c)^2 + 4*a*b*d*x^2*real_part(cos_integral(d*x))*
tan(1/2*d*x)^2 + 4*a*b*d*x^2*real_part(cos_integral(-d*x))*tan(1/2*d*x)^2
- 2*a^2*d^2*x^2*real_part(cos_integral(d*x))*tan(1/2*c) - 2*a^2*d^2*x^2*re
al_part(cos_integral(-d*x))*tan(1/2*c) + 4*b^2*x^2*real_part(cos_integr...
```

### 3.15.9 Mupad [F(-1)]

Timed out.

$$\int \frac{(a+bx)^2\sin(c+dx)}{x^3}\,dx = \int \frac{\sin(c+d\,x)\,(a+b\,x)^2}{x^3}\,dx$$

input
```
int((sin(c + d*x)*(a + b*x)^2)/x^3,x)
```

output
```
int((sin(c + d*x)*(a + b*x)^2)/x^3, x)
```

# 3.16 $\int \frac{(a+bx)^2 \sin(c+dx)}{x^4} \, dx$



## 3.16.1 Optimal result

Integrand size = 17, antiderivative size = 175

$$\int \frac{(a+bx)^2 \sin(c+dx)}{x^4} \, dx = -\frac{a^2 d \cos(c+dx)}{6x^2} - \frac{abd \cos(c+dx)}{x} + b^2 d \cos(c) \operatorname{CosIntegral}(dx) - \frac{1}{6} a^2 d^3 \cos(c) \operatorname{CosIntegral}(dx) - abd^2 \operatorname{CosIntegral}(dx) \sin(c) - \frac{a^2 \sin(c+dx)}{3x^3} - \frac{ab \sin(c+dx)}{x^2} - \frac{b^2 \sin(c+dx)}{x} + \frac{a^2 d^2 \sin(c+dx)}{6x} - abd^2 \cos(c) \operatorname{Si}(dx) - b^2 d \sin(c) \operatorname{Si}(dx) + \frac{1}{6} a^2 d^3 \sin(c) \operatorname{Si}(dx)$$

output
```
b^2*d*Ci(d*x)*cos(c)-1/6*a^2*d^3*Ci(d*x)*cos(c)-1/6*a^2*d*cos(d*x+c)/x^2-a
*b*d*cos(d*x+c)/x-a*b*d^2*cos(c)*Si(d*x)-a*b*d^2*Ci(d*x)*sin(c)-b^2*d*Si(d
*x)*sin(c)+1/6*a^2*d^3*Si(d*x)*sin(c)-1/3*a^2*sin(d*x+c)/x^3-a*b*sin(d*x+c
)/x^2-b^2*sin(d*x+c)/x+1/6*a^2*d^2*sin(d*x+c)/x
```

### 3.16.2 Mathematica [A] (verified)

Time = 0.35 (sec) , antiderivative size = 154, normalized size of antiderivative = 0.88

$$\int \frac{(a+bx)^2\sin(c+dx)}{x^4}\,dx =$$
$$-\frac{a^2dx\cos(c+dx)+6abdx^2\cos(c+dx)+dx^3\,\text{CosIntegral}(dx)\left(\left(-6b^2+a^2d^2\right)\cos(c)+6abd\sin(c)\right)+2a}{}$$

input
```
Integrate[((a + b*x)^2*Sin[c + d*x])/x^4,x]
```

output
```
-1/6*(a^2*d*x*Cos[c + d*x] + 6*a*b*d*x^2*Cos[c + d*x] + d*x^3*CosIntegral[
d*x]*((-6*b^2 + a^2*d^2)*Cos[c] + 6*a*b*d*Sin[c]) + 2*a^2*Sin[c + d*x] + 6
*a*b*x*Sin[c + d*x] + 6*b^2*x^2*Sin[c + d*x] - a^2*d^2*x^2*Sin[c + d*x] +
d*x^3*(6*a*b*d*Cos[c] + 6*b^2*Sin[c] - a^2*d^2*Sin[c])*SinIntegral[d*x])/x
^3
```

### 3.16.3 Rubi [A] (verified)

Time = 0.58 (sec) , antiderivative size = 175, normalized size of antiderivative = 1.00, number of steps used = 2, number of rules used = 2, $\frac{\text{number of rules}}{\text{integrand size}} = 0.118$, Rules used = {7293, 2009}

Below are the steps used by Rubi to obtain the solution. The rule number used for the transformation is given above next to the arrow. The rules definitions used are listed below.

$$\int \frac{(a+bx)^2\sin(c+dx)}{x^4}\,dx$$
$$\Big\downarrow \text{7293}$$
$$\int \left(\frac{a^2\sin(c+dx)}{x^4}+\frac{2ab\sin(c+dx)}{x^3}+\frac{b^2\sin(c+dx)}{x^2}\right)dx$$
$$\Big\downarrow \text{2009}$$
$$-\frac{1}{6}a^2d^3\cos(c)\,\text{CosIntegral}(dx)+\frac{1}{6}a^2d^3\sin(c)\text{Si}(dx)+\frac{a^2d^2\sin(c+dx)}{6x}-\frac{a^2\sin(c+dx)}{3x^3}-\frac{a^2d\cos(c+dx)}{6x^2}-abd^2\sin(c)\,\text{CosIntegral}(dx)-abd^2\cos(c)\text{Si}(dx)-\frac{ab\sin(c+dx)}{x^2}-\frac{abd\cos(c+dx)}{x}+b^2d\cos(c)\,\text{CosIntegral}(dx)-b^2d\sin(c)\text{Si}(dx)-\frac{b^2\sin(c+dx)}{x}$$

input
```
Int[((a + b*x)^2*Sin[c + d*x])/x^4,x]
```

output
```
-1/6*(a^2*d*Cos[c + d*x])/x^2 - (a*b*d*Cos[c + d*x])/x + b^2*d*Cos[c]*CosI
ntegral[d*x] - (a^2*d^3*Cos[c]*CosIntegral[d*x])/6 - a*b*d^2*CosIntegral[d
*x]*Sin[c] - (a^2*Sin[c + d*x])/(3*x^3) - (a*b*Sin[c + d*x])/x^2 - (b^2*Si
n[c + d*x])/x + (a^2*d^2*Sin[c + d*x])/(6*x) - a*b*d^2*Cos[c]*SinIntegral[
d*x] - b^2*d*Sin[c]*SinIntegral[d*x] + (a^2*d^3*Sin[c]*SinIntegral[d*x])/6
```

### 3.16.3.1 Defintions of rubi rules used

rule 2009
```
Int[u_, x_Symbol] :> Simp[IntSum[u, x], x] /; SumQ[u]
```

rule 7293
```
Int[u_, x_Symbol] :> With[{v = ExpandIntegrand[u, x]}, Int[v, x] /; SumQ[v]
]
```

## 3.16.4 Maple [A] (verified)

Time = 0.30 (sec) , antiderivative size = 158, normalized size of antiderivative = 0.90

| method | result |
|---|---|
| derivativedivides | $d^{3}\left(a^{2}\left(-\frac{\sin(dx+c)}{3d^{3}x^{3}}-\frac{\cos(dx+c)}{6d^{2}x^{2}}+\frac{\sin(dx+c)}{6dx}+\frac{\mathrm{Si}(dx)\sin(c)}{6}-\frac{\mathrm{Ci}(dx)\cos(c)}{6}\right)+\frac{2ab\left(-\frac{\sin(dx+c)}{2d^{2}x^{2}}-\frac{\cos(dx}{2dx}\right.}{}\right.$ |
| default | $d^{3}\left(a^{2}\left(-\frac{\sin(dx+c)}{3d^{3}x^{3}}-\frac{\cos(dx+c)}{6d^{2}x^{2}}+\frac{\sin(dx+c)}{6dx}+\frac{\mathrm{Si}(dx)\sin(c)}{6}-\frac{\mathrm{Ci}(dx)\cos(c)}{6}\right)+\frac{2ab\left(-\frac{\sin(dx+c)}{2d^{2}x^{2}}-\frac{\cos(dx}{2dx}\right.}{}\right.$ |
| risch | $-\frac{i\cos(c)\,\mathrm{Ei}_{1}(-idx)ab\,d^{2}}{2}+\frac{i\cos(c)\,\mathrm{Ei}_{1}(idx)ab\,d^{2}}{2}+\frac{\cos(c)\,\mathrm{Ei}_{1}(-idx)a^{2}d^{3}}{12}+\frac{\cos(c)\,\mathrm{Ei}_{1}(idx)a^{2}d^{3}}{12}-\frac{\cos(c)\,\mathrm{Ei}_{1}(-}{2}$ |
| meijerg | $\frac{d^{2}b^{2}\sqrt{\pi}\,\sin(c)\left(-\frac{4d^{2}\cos\left(x\sqrt{d^{2}}\right)}{x\left(d^{2}\right)^{\frac{3}{2}}\sqrt{\pi}}-\frac{4\,\mathrm{Si}\left(x\sqrt{d^{2}}\right)}{\sqrt{\pi}}\right)}{4\sqrt{d^{2}}}+\frac{d\,b^{2}\sqrt{\pi}\,\cos(c)\left(\frac{4\gamma-4+4\ln(x)+4\ln(d)}{\sqrt{\pi}}+\frac{4}{\sqrt{\pi}}-\frac{4\gamma}{\sqrt{\pi}}-\frac{4\ln(2)}{\sqrt{\pi}}-\frac{4\ln\left(\frac{dx}{2}\right)}{\sqrt{\pi}}\right.}{4}$ |

input
```
int((b*x+a)^2*sin(d*x+c)/x^4,x,method=_RETURNVERBOSE)
```

output
```
d^3*(a^2*(-1/3*sin(d*x+c)/d^3/x^3-1/6*cos(d*x+c)/d^2/x^2+1/6*sin(d*x+c)/d/
x+1/6*Si(d*x)*sin(c)-1/6*Ci(d*x)*cos(c))+2/d*a*b*(-1/2*sin(d*x+c)/d^2/x^2-
1/2*cos(d*x+c)/d/x-1/2*Si(d*x)*cos(c)-1/2*Ci(d*x)*sin(c))+1/d^2*b^2*(-sin(
d*x+c)/d/x-Si(d*x)*sin(c)+Ci(d*x)*cos(c)))
```

### 3.16.5 Fricas [A] (verification not implemented)

Time = 0.26 (sec) , antiderivative size = 145, normalized size of antiderivative = 0.83

$$\int \frac{(a+bx)^2\sin(c+dx)}{x^4}\,dx = -\frac{(6\,abdx^2+a^2dx)\cos{(dx+c)}+(6\,abd^2x^3\operatorname{Si}{(dx)}+(a^2d^3-6\,b^2d)x^3\operatorname{Ci}{(dx)})\cos{(c)}+(6\,abx-(a^2d^2-}{6\,x^3}$$

input
```
integrate((b*x+a)^2*sin(d*x+c)/x^4,x, algorithm="fricas")
```

output
```
-1/6*((6*a*b*d*x^2 + a^2*d*x)*cos(d*x + c) + (6*a*b*d^2*x^3*sin_integral(d
*x) + (a^2*d^3 - 6*b^2*d)*x^3*cos_integral(d*x))*cos(c) + (6*a*b*x - (a^2*
d^2 - 6*b^2)*x^2 + 2*a^2)*sin(d*x + c) + (6*a*b*d^2*x^3*cos_integral(d*x)
- (a^2*d^3 - 6*b^2*d)*x^3*sin_integral(d*x))*sin(c))/x^3
```

### 3.16.6 Sympy [F]

$$\int \frac{(a+bx)^2\sin(c+dx)}{x^4}\,dx = \int \frac{(a+bx)^2\sin{(c+dx)}}{x^4}\,dx$$

input
```
integrate((b*x+a)**2*sin(d*x+c)/x**4,x)
```

output
```
Integral((a + b*x)**2*sin(c + d*x)/x**4, x)
```

### 3.16.7 Maxima [C] (verification not implemented)

Result contains complex when optimal does not.

Time = 1.24 (sec) , antiderivative size = 187, normalized size of antiderivative = 1.07

$$\int \frac{(a+bx)^2\sin(c+dx)}{x^4}\,dx = -\frac{((a^2(\Gamma(-3,i\,dx)+\Gamma(-3,-i\,dx))\cos{(c)}+a^2(-i\,\Gamma(-3,i\,dx)+i\,\Gamma(-3,-i\,dx))\sin{(c)})d^5-6\,(ab(-i\,\Gamma(}{}$$

input
```
integrate((b*x+a)^2*sin(d*x+c)/x^4,x, algorithm="maxima")
```

output
```
-1/2*(((a^2*(gamma(-3, I*d*x) + gamma(-3, -I*d*x))*cos(c) + a^2*(-I*gamma(
-3, I*d*x) + I*gamma(-3, -I*d*x))*sin(c))*d^5 - 6*(a*b*(-I*gamma(-3, I*d*x
) + I*gamma(-3, -I*d*x))*cos(c) - a*b*(gamma(-3, I*d*x) + gamma(-3, -I*d*x
))*sin(c))*d^4 - 6*(b^2*(gamma(-3, I*d*x) + gamma(-3, -I*d*x))*cos(c) + b^
2*(-I*gamma(-3, I*d*x) + I*gamma(-3, -I*d*x))*sin(c))*d^3)*x^3 + 4*b^2*sin
(d*x + c) + 2*(b^2*d*x + 2*a*b*d)*cos(d*x + c))/(d^2*x^3)
```

### 3.16.8 Giac [C] (verification not implemented)

Result contains higher order function than in optimal. Order 9 vs. order 4.

Time = 0.30 (sec) , antiderivative size = 1400, normalized size of antiderivative = 8.00

$$\int \frac{(a+bx)^2 \sin(c+dx)}{x^4} \, dx = \text{Too large to display}$$

input
```
integrate((b*x+a)^2*sin(d*x+c)/x^4,x, algorithm="giac")
```

output
```
1/12*(a^2*d^3*x^3*real_part(cos_integral(d*x))*tan(1/2*d*x)^2*tan(1/2*c)^2
 + a^2*d^3*x^3*real_part(cos_integral(-d*x))*tan(1/2*d*x)^2*tan(1/2*c)^2 +
 2*a^2*d^3*x^3*imag_part(cos_integral(d*x))*tan(1/2*d*x)^2*tan(1/2*c) - 2*
a^2*d^3*x^3*imag_part(cos_integral(-d*x))*tan(1/2*d*x)^2*tan(1/2*c) + 4*a^
2*d^3*x^3*sin_integral(d*x)*tan(1/2*d*x)^2*tan(1/2*c) + 6*a*b*d^2*x^3*imag
_part(cos_integral(d*x))*tan(1/2*d*x)^2*tan(1/2*c)^2 - 6*a*b*d^2*x^3*imag_
part(cos_integral(-d*x))*tan(1/2*d*x)^2*tan(1/2*c)^2 + 12*a*b*d^2*x^3*sin_
integral(d*x)*tan(1/2*d*x)^2*tan(1/2*c)^2 - a^2*d^3*x^3*real_part(cos_inte
gral(d*x))*tan(1/2*d*x)^2 - a^2*d^3*x^3*real_part(cos_integral(-d*x))*tan(
1/2*d*x)^2 - 12*a*b*d^2*x^3*real_part(cos_integral(d*x))*tan(1/2*d*x)^2*ta
n(1/2*c) - 12*a*b*d^2*x^3*real_part(cos_integral(-d*x))*tan(1/2*d*x)^2*tan
(1/2*c) + a^2*d^3*x^3*real_part(cos_integral(d*x))*tan(1/2*c)^2 + a^2*d^3*
x^3*real_part(cos_integral(-d*x))*tan(1/2*c)^2 - 6*b^2*d*x^3*real_part(cos
_integral(d*x))*tan(1/2*d*x)^2*tan(1/2*c)^2 - 6*b^2*d*x^3*real_part(cos_in
tegral(-d*x))*tan(1/2*d*x)^2*tan(1/2*c)^2 - 6*a*b*d^2*x^3*imag_part(cos_in
tegral(d*x))*tan(1/2*d*x)^2 + 6*a*b*d^2*x^3*imag_part(cos_integral(-d*x))*
tan(1/2*d*x)^2 - 12*a*b*d^2*x^3*sin_integral(d*x)*tan(1/2*d*x)^2 + 2*a^2*d
^3*x^3*imag_part(cos_integral(d*x))*tan(1/2*c) - 2*a^2*d^3*x^3*imag_part(c
os_integral(-d*x))*tan(1/2*c) + 4*a^2*d^3*x^3*sin_integral(d*x)*tan(1/2*c)
 - 12*b^2*d*x^3*imag_part(cos_integral(d*x))*tan(1/2*d*x)^2*tan(1/2*c) ...
```

### 3.16.9 Mupad [F(-1)]

Timed out.

$$\int \frac{(a+bx)^2\sin(c+dx)}{x^4}\,dx=\int \frac{\sin\left(c+d\,x\right)\,\left(a+b\,x\right)^2}{x^4}\,dx$$

input
```
int((sin(c + d*x)*(a + b*x)^2)/x^4,x)
```

output
```
int((sin(c + d*x)*(a + b*x)^2)/x^4, x)
```

# 3.17 $\int \frac{(a+bx)^2 \sin(c+dx)}{x^5} \, dx$



## 3.17.1 Optimal result

Integrand size = 17, antiderivative size = 248

$$\begin{aligned}\int \frac{(a+bx)^2 \sin(c+dx)}{x^5} \, dx = & -\frac{a^2 d \cos(c+dx)}{12x^3} - \frac{abd \cos(c+dx)}{3x^2} - \frac{b^2 d \cos(c+dx)}{2x} \\ & + \frac{a^2 d^3 \cos(c+dx)}{24x} - \frac{1}{3} abd^3 \cos(c) \operatorname{CosIntegral}(dx) \\ & - \frac{1}{2} b^2 d^2 \operatorname{CosIntegral}(dx) \sin(c) + \frac{1}{24} a^2 d^4 \operatorname{CosIntegral}(dx) \sin(c) \\ & - \frac{a^2 \sin(c+dx)}{4x^4} - \frac{2ab \sin(c+dx)}{3x^3} - \frac{b^2 \sin(c+dx)}{2x^2} \\ & + \frac{a^2 d^2 \sin(c+dx)}{24x^2} + \frac{abd^2 \sin(c+dx)}{3x} - \frac{1}{2} b^2 d^2 \cos(c) \operatorname{Si}(dx) \\ & + \frac{1}{24} a^2 d^4 \cos(c) \operatorname{Si}(dx) + \frac{1}{3} abd^3 \sin(c) \operatorname{Si}(dx)\end{aligned}$$

output
```
-1/3*a*b*d^3*Ci(d*x)*cos(c)-1/12*a^2*d*cos(d*x+c)/x^3-1/3*a*b*d*cos(d*x+c)
/x^2-1/2*b^2*d*cos(d*x+c)/x+1/24*a^2*d^3*cos(d*x+c)/x-1/2*b^2*d^2*cos(c)*S
i(d*x)+1/24*a^2*d^4*cos(c)*Si(d*x)-1/2*b^2*d^2*Ci(d*x)*sin(c)+1/24*a^2*d^4
*Ci(d*x)*sin(c)+1/3*a*b*d^3*Si(d*x)*sin(c)-1/4*a^2*sin(d*x+c)/x^4-2/3*a*b*
sin(d*x+c)/x^3-1/2*b^2*sin(d*x+c)/x^2+1/24*a^2*d^2*sin(d*x+c)/x^2+1/3*a*b*
d^2*sin(d*x+c)/x
```

### 3.17.2 Mathematica [A] (verified)

Time = 0.27 (sec) , antiderivative size = 204, normalized size of antiderivative = 0.82

$$\int \frac{(a+bx)^2\sin(c+dx)}{x^5}\,dx$$
$$= \frac{-2a^2dx\cos(c+dx) - 8abdx^2\cos(c+dx) - 12b^2dx^3\cos(c+dx) + a^2d^3x^3\cos(c+dx) + d^2x^4\,\text{CosIntegral}}{}$$

input
```
Integrate[((a + b*x)^2*Sin[c + d*x])/x^5,x]
```

output
```
(-2*a^2*d*x*Cos[c + d*x] - 8*a*b*d*x^2*Cos[c + d*x] - 12*b^2*d*x^3*Cos[c +
 d*x] + a^2*d^3*x^3*Cos[c + d*x] + d^2*x^4*CosIntegral[d*x]*(-8*a*b*d*Cos[
c] + (-12*b^2 + a^2*d^2)*Sin[c]) - 6*a^2*Sin[c + d*x] - 16*a*b*x*Sin[c + d
*x] - 12*b^2*x^2*Sin[c + d*x] + a^2*d^2*x^2*Sin[c + d*x] + 8*a*b*d^2*x^3*S
in[c + d*x] + d^2*x^4*(-12*b^2*Cos[c] + a^2*d^2*Cos[c] + 8*a*b*d*Sin[c])*S
inIntegral[d*x])/(24*x^4)
```

### 3.17.3 Rubi [A] (verified)

Time = 0.66 (sec) , antiderivative size = 248, normalized size of antiderivative = 1.00, number of steps used = 2, number of rules used = 2, $\frac{\text{number of rules}}{\text{integrand size}} = 0.118$, Rules used = {7293, 2009}

Below are the steps used by Rubi to obtain the solution. The rule number used for the transformation is given above next to the arrow. The rules definitions used are listed below.

$$\int \frac{(a+bx)^2\sin(c+dx)}{x^5}\,dx$$
$$\Big\downarrow \text{7293}$$
$$\int \left(\frac{a^2\sin(c+dx)}{x^5} + \frac{2ab\sin(c+dx)}{x^4} + \frac{b^2\sin(c+dx)}{x^3}\right)dx$$
$$\Big\downarrow \text{2009}$$

$$\frac{1}{24}a^2d^4\sin(c)\,\mathrm{CosIntegral}(dx)+\frac{1}{24}a^2d^4\cos(c)\mathrm{Si}(dx)+\frac{a^2d^3\cos(c+dx)}{24x}+\frac{a^2d^2\sin(c+dx)}{24x^2}-\frac{a^2\sin(c+dx)}{4x^4}-\frac{a^2d\cos(c+dx)}{12x^3}-\frac{1}{3}abd^3\cos(c)\,\mathrm{CosIntegral}(dx)+\frac{1}{3}abd^3\sin(c)\mathrm{Si}(dx)+\frac{abd^2\sin(c+dx)}{3x}-\frac{2ab\sin(c+dx)}{3x^3}-\frac{abd\cos(c+dx)}{3x^2}-\frac{1}{2}b^2d^2\sin(c)\,\mathrm{CosIntegral}(dx)-\frac{1}{2}b^2d^2\cos(c)\mathrm{Si}(dx)-\frac{b^2\sin(c+dx)}{2x^2}-\frac{b^2d\cos(c+dx)}{2x}$$

input
```
Int[((a + b*x)^2*Sin[c + d*x])/x^5,x]
```

output
```
-1/12*(a^2*d*Cos[c + d*x])/x^3 - (a*b*d*Cos[c + d*x])/(3*x^2) - (b^2*d*Cos
[c + d*x])/(2*x) + (a^2*d^3*Cos[c + d*x])/(24*x) - (a*b*d^3*Cos[c]*CosInte
gral[d*x])/3 - (b^2*d^2*CosIntegral[d*x]*Sin[c])/2 + (a^2*d^4*CosIntegral[
d*x]*Sin[c])/24 - (a^2*Sin[c + d*x])/(4*x^4) - (2*a*b*Sin[c + d*x])/(3*x^3
) - (b^2*Sin[c + d*x])/(2*x^2) + (a^2*d^2*Sin[c + d*x])/(24*x^2) + (a*b*d^
2*Sin[c + d*x])/(3*x) - (b^2*d^2*Cos[c]*SinIntegral[d*x])/2 + (a^2*d^4*Cos
[c]*SinIntegral[d*x])/24 + (a*b*d^3*Sin[c]*SinIntegral[d*x])/3
```

### 3.17.3.1 Defintions of rubi rules used

rule 2009
```
Int[u_, x_Symbol] :> Simp[IntSum[u, x], x] /; SumQ[u]
```

rule 7293
```
Int[u_, x_Symbol] :> With[{v = ExpandIntegrand[u, x]}, Int[v, x] /; SumQ[v]
]
```

### 3.17.4 Maple [A] (verified)

Time = 0.34 (sec) , antiderivative size = 201, normalized size of antiderivative = 0.81

| method | result |
|---|---|
| derivativedivides | $d^4\left(a^2\left(-\frac{\sin(dx+c)}{4d^4x^4}-\frac{\cos(dx+c)}{12d^3x^3}+\frac{\sin(dx+c)}{24d^2x^2}+\frac{\cos(dx+c)}{24dx}+\frac{\mathrm{Si}(dx)\cos(c)}{24}+\frac{\mathrm{Ci}(dx)\sin(c)}{24}\right)+\frac{2ab\left(-\frac{\sin}{3}\cdots\right.}{\cdots}\right.$ |
| default | $d^4\left(a^2\left(-\frac{\sin(dx+c)}{4d^4x^4}-\frac{\cos(dx+c)}{12d^3x^3}+\frac{\sin(dx+c)}{24d^2x^2}+\frac{\cos(dx+c)}{24dx}+\frac{\mathrm{Si}(dx)\cos(c)}{24}+\frac{\mathrm{Ci}(dx)\sin(c)}{24}\right)+\frac{2ab\left(-\frac{\sin}{3}\cdots\right.}{\cdots}\right.$ |
| risch | $\frac{\cos(c)\,\mathrm{Ei}_1(idx)ab\,d^3}{6}-\frac{i\cos(c)\,\mathrm{Ei}_1(idx)a^2d^4}{48}+\frac{\cos(c)\,\mathrm{Ei}_1(-idx)ab\,d^3}{6}+\frac{i\cos(c)\,\mathrm{Ei}_1(-idx)a^2d^4}{48}+\frac{i\cos(c)\,\mathrm{Ei}_1(idx\cdots}{4}$ |
| meijerg | $\frac{d^2b^2\sqrt{\pi}\,\sin(c)\left(-\frac{4}{\sqrt{\pi}\,x^2d^2}-\frac{2\left(2\gamma-3+2\ln(x)+\ln\left(d^2\right)\right)}{\sqrt{\pi}}+\frac{-6d^2x^2+4}{\sqrt{\pi}\,x^2d^2}+\frac{4\gamma}{\sqrt{\pi}}+\frac{4\ln(2)}{\sqrt{\pi}}+\frac{4\ln\left(\frac{dx}{2}\right)}{\sqrt{\pi}}-\frac{4\cos(dx)}{\sqrt{\pi}\,d^2x^2}+\frac{4\sin(dx)}{\sqrt{\pi}\,dx}-\frac{4\,\mathrm{Ci}(dx)}{\sqrt{\pi}}\cdots\right.}{8}$ |

input
```
int((b*x+a)^2*sin(d*x+c)/x^5,x,method=_RETURNVERBOSE)
```

output
```
d^4*(a^2*(-1/4*sin(d*x+c)/d^4/x^4-1/12*cos(d*x+c)/d^3/x^3+1/24*sin(d*x+c)/
d^2/x^2+1/24*cos(d*x+c)/d/x+1/24*Si(d*x)*cos(c)+1/24*Ci(d*x)*sin(c))+2*a*b
/d*(-1/3*sin(d*x+c)/d^3/x^3-1/6*cos(d*x+c)/d^2/x^2+1/6*sin(d*x+c)/d/x+1/6*
Si(d*x)*sin(c)-1/6*Ci(d*x)*cos(c))+b^2/d^2*(-1/2*sin(d*x+c)/d^2/x^2-1/2*co
s(d*x+c)/d/x-1/2*Si(d*x)*cos(c)-1/2*Ci(d*x)*sin(c)))
```

### 3.17.5 Fricas [A] (verification not implemented)

Time = 0.27 (sec) , antiderivative size = 180, normalized size of antiderivative = 0.73

$$\int \frac{(a+bx)^2\sin(c+dx)}{x^5}\,dx = -\frac{(8\,abdx^2+2\,a^2dx-(a^2d^3-12\,b^2d)x^3)\cos(dx+c)+(8\,abd^3x^4\,\mathrm{Ci}\,(dx)-(a^2d^4-12\,b^2d^2)x^4\,\mathrm{Si}\,(dx))\,\mathrm{co}\cdots}{\cdots}$$

input
```
integrate((b*x+a)^2*sin(d*x+c)/x^5,x, algorithm="fricas")
```

output
```
-1/24*((8*a*b*d*x^2 + 2*a^2*d*x - (a^2*d^3 - 12*b^2*d)*x^3)*cos(d*x + c) +
 (8*a*b*d^3*x^4*cos_integral(d*x) - (a^2*d^4 - 12*b^2*d^2)*x^4*sin_integra
l(d*x))*cos(c) - (8*a*b*d^2*x^3 - 16*a*b*x + (a^2*d^2 - 12*b^2)*x^2 - 6*a^
2)*sin(d*x + c) - (8*a*b*d^3*x^4*sin_integral(d*x) + (a^2*d^4 - 12*b^2*d^2
)*x^4*cos_integral(d*x))*sin(c))/x^4
```

### 3.17.6 Sympy [F]

$$\int \frac{(a+bx)^2 \sin(c+dx)}{x^5}\,dx = \int \frac{(a+bx)^2 \sin{(c+dx)}}{x^5}\,dx$$

input
```
integrate((b*x+a)**2*sin(d*x+c)/x**5,x)
```

output
```
Integral((a + b*x)**2*sin(c + d*x)/x**5, x)
```

### 3.17.7 Maxima [C] (verification not implemented)

Result contains complex when optimal does not.

Time = 1.36 (sec) , antiderivative size = 186, normalized size of antiderivative = 0.75

$$\int \frac{(a+bx)^2 \sin(c+dx)}{x^5}\,dx = -\frac{((a^2(i\,\Gamma(-4,i\,dx) - i\,\Gamma(-4,-i\,dx))\cos{(c)} + a^2(\Gamma(-4,i\,dx) + \Gamma(-4,-i\,dx))\sin{(c)})d^6 - 8\,(ab(\Gamma(-4,i}{}$$

input
```
integrate((b*x+a)^2*sin(d*x+c)/x^5,x, algorithm="maxima")
```

output
```
-1/2*(((a^2*(I*gamma(-4, I*d*x) - I*gamma(-4, -I*d*x))*cos(c) + a^2*(gamma
(-4, I*d*x) + gamma(-4, -I*d*x))*sin(c))*d^6 - 8*(a*b*(gamma(-4, I*d*x) +
gamma(-4, -I*d*x))*cos(c) + a*b*(-I*gamma(-4, I*d*x) + I*gamma(-4, -I*d*x)
)*sin(c))*d^5 - 12*(b^2*(I*gamma(-4, I*d*x) - I*gamma(-4, -I*d*x))*cos(c)
+ b^2*(gamma(-4, I*d*x) + gamma(-4, -I*d*x))*sin(c))*d^4)*x^4 + 6*b^2*sin(
d*x + c) + 2*(b^2*d*x + 2*a*b*d)*cos(d*x + c))/(d^2*x^4)
```

### 3.17.8 Giac [C] (verification not implemented)

Result contains higher order function than in optimal. Order 9 vs. order 4.

Time = 0.32 (sec) , antiderivative size = 1712, normalized size of antiderivative = 6.90

$$\int \frac{(a+bx)^2 \sin(c+dx)}{x^5}\,dx = \text{Too large to display}$$

input
```
integrate((b*x+a)^2*sin(d*x+c)/x^5,x, algorithm="giac")
```

output
```
-1/48*(a^2*d^4*x^4*imag_part(cos_integral(d*x))*tan(1/2*d*x)^2*tan(1/2*c)^
2 - a^2*d^4*x^4*imag_part(cos_integral(-d*x))*tan(1/2*d*x)^2*tan(1/2*c)^2
+ 2*a^2*d^4*x^4*sin_integral(d*x)*tan(1/2*d*x)^2*tan(1/2*c)^2 - 2*a^2*d^4*
x^4*real_part(cos_integral(d*x))*tan(1/2*d*x)^2*tan(1/2*c) - 2*a^2*d^4*x^4
*real_part(cos_integral(-d*x))*tan(1/2*d*x)^2*tan(1/2*c) - 8*a*b*d^3*x^4*r
eal_part(cos_integral(d*x))*tan(1/2*d*x)^2*tan(1/2*c)^2 - 8*a*b*d^3*x^4*re
al_part(cos_integral(-d*x))*tan(1/2*d*x)^2*tan(1/2*c)^2 - a^2*d^4*x^4*imag
_part(cos_integral(d*x))*tan(1/2*d*x)^2 + a^2*d^4*x^4*imag_part(cos_integr
al(-d*x))*tan(1/2*d*x)^2 - 2*a^2*d^4*x^4*sin_integral(d*x)*tan(1/2*d*x)^2
- 16*a*b*d^3*x^4*imag_part(cos_integral(d*x))*tan(1/2*d*x)^2*tan(1/2*c) +
16*a*b*d^3*x^4*imag_part(cos_integral(-d*x))*tan(1/2*d*x)^2*tan(1/2*c) - 3
2*a*b*d^3*x^4*sin_integral(d*x)*tan(1/2*d*x)^2*tan(1/2*c) + a^2*d^4*x^4*im
ag_part(cos_integral(d*x))*tan(1/2*c)^2 - a^2*d^4*x^4*imag_part(cos_integr
al(-d*x))*tan(1/2*c)^2 + 2*a^2*d^4*x^4*sin_integral(d*x)*tan(1/2*c)^2 - 12
*b^2*d^2*x^4*imag_part(cos_integral(d*x))*tan(1/2*d*x)^2*tan(1/2*c)^2 + 12
*b^2*d^2*x^4*imag_part(cos_integral(-d*x))*tan(1/2*d*x)^2*tan(1/2*c)^2 - 2
4*b^2*d^2*x^4*sin_integral(d*x)*tan(1/2*d*x)^2*tan(1/2*c)^2 + 8*a*b*d^3*x^
4*real_part(cos_integral(d*x))*tan(1/2*d*x)^2 + 8*a*b*d^3*x^4*real_part(co
s_integral(-d*x))*tan(1/2*d*x)^2 - 2*a^2*d^4*x^4*real_part(cos_integral(d*
x))*tan(1/2*c) - 2*a^2*d^4*x^4*real_part(cos_integral(-d*x))*tan(1/2*c)...
```

### 3.17.9 Mupad [F(-1)]

Timed out.

$$\int \frac{(a+bx)^2\sin(c+dx)}{x^5}\,dx=\int \frac{\sin\left(c+d\,x\right)\,\left(a+b\,x\right)^2}{x^5}\,dx$$

input
```
int((sin(c + d*x)*(a + b*x)^2)/x^5,x)
```

output
```
int((sin(c + d*x)*(a + b*x)^2)/x^5, x)
```

# 3.18 $\int \frac{x^4 \sin(c+dx)}{a+bx} \, dx$



## 3.18.1 Optimal result

Integrand size = 17, antiderivative size = 218

$$\int \frac{x^4 \sin(c+dx)}{a+bx} \, dx = -\frac{2a \cos(c+dx)}{b^2 d^3} + \frac{a^3 \cos(c+dx)}{b^4 d} + \frac{6x \cos(c+dx)}{bd^3} - \frac{a^2 x \cos(c+dx)}{b^3 d} + \frac{a x^2 \cos(c+dx)}{b^2 d} - \frac{x^3 \cos(c+dx)}{bd} + \frac{a^4 \operatorname{CosIntegral}\left(\frac{ad}{b} + dx\right) \sin\left(c - \frac{ad}{b}\right)}{b^5} - \frac{6 \sin(c+dx)}{bd^4} + \frac{a^2 \sin(c+dx)}{b^3 d^2} - \frac{2ax \sin(c+dx)}{b^2 d^2} + \frac{3x^2 \sin(c+dx)}{bd^2} + \frac{a^4 \cos\left(c - \frac{ad}{b}\right) \operatorname{Si}\left(\frac{ad}{b} + dx\right)}{b^5}$$

output
```
-2*a*cos(d*x+c)/b^2/d^3+a^3*cos(d*x+c)/b^4/d+6*x*cos(d*x+c)/b/d^3-a^2*x*co
s(d*x+c)/b^3/d+a*x^2*cos(d*x+c)/b^2/d-x^3*cos(d*x+c)/b/d+a^4*cos(-c+a*d/b)
*Si(a*d/b+d*x)/b^5-a^4*Ci(a*d/b+d*x)*sin(-c+a*d/b)/b^5-6*sin(d*x+c)/b/d^4+
a^2*sin(d*x+c)/b^3/d^2-2*a*x*sin(d*x+c)/b^2/d^2+3*x^2*sin(d*x+c)/b/d^2
```

## 3.18.2 Mathematica [A] (verified)

Time = 0.41 (sec) , antiderivative size = 158, normalized size of antiderivative = 0.72

$$\int \frac{x^4 \sin(c+dx)}{a+bx} \, dx$$
$$= \frac{a^4 d^4 \operatorname{CosIntegral}\left(d\left(\frac{a}{b}+x\right)\right) \sin\left(c-\frac{ad}{b}\right) + b(d(a^3 d^2 - a^2 b d^2 x + b^3 x(6-d^2x^2) + ab^2(-2+d^2x^2)) \cos(c+}{b^5 d^4}$$

input
```
Integrate[(x^4*Sin[c + d*x])/(a + b*x),x]
```

output
```
(a^4*d^4*CosIntegral[d*(a/b + x)]*Sin[c - (a*d)/b] + b*(d*(a^3*d^2 - a^2*b
*d^2*x + b^3*x*(6 - d^2*x^2) + a*b^2*(-2 + d^2*x^2))*Cos[c + d*x] + b*(a^2
*d^2 - 2*a*b*d^2*x + 3*b^2*(-2 + d^2*x^2))*Sin[c + d*x]) + a^4*d^4*Cos[c -
 (a*d)/b]*SinIntegral[d*(a/b + x)])/(b^5*d^4)
```

## 3.18.3 Rubi [A] (verified)

Time = 0.66 (sec) , antiderivative size = 218, normalized size of antiderivative = 1.00, number of steps used = 2, number of rules used = 2, $\frac{\text{number of rules}}{\text{integrand size}}$ = 0.118, Rules used = {7293, 2009}

Below are the steps used by Rubi to obtain the solution. The rule number used for the transformation is given above next to the arrow. The rules definitions used are listed below.

$$\int \frac{x^4 \sin(c+dx)}{a+bx} \, dx$$
$$\Big\downarrow \; 7293$$
$$\int \left(\frac{a^4 \sin(c+dx)}{b^4(a+bx)} - \frac{a^3 \sin(c+dx)}{b^4} + \frac{a^2 x \sin(c+dx)}{b^3} - \frac{ax^2 \sin(c+dx)}{b^2} + \frac{x^3 \sin(c+dx)}{b}\right) dx$$
$$\Big\downarrow \; 2009$$
$$\frac{a^4 \sin\left(c-\frac{ad}{b}\right) \operatorname{CosIntegral}\left(xd+\frac{ad}{b}\right)}{b^5} + \frac{a^4 \cos\left(c-\frac{ad}{b}\right) \operatorname{Si}\left(xd+\frac{ad}{b}\right)}{b^5} + \frac{a^3 \cos(c+dx)}{b^4 d} + \frac{a^2 \sin(c+dx)}{b^3 d^2} - \frac{a^2 x \cos(c+dx)}{b^3 d} - \frac{2a \cos(c+dx)}{b^2 d^3} - \frac{2ax \sin(c+dx)}{b^2 d^2} + \frac{ax^2 \cos(c+dx)}{b^2 d} - \frac{6 \sin(c+dx)}{bd^4} + \frac{6x \cos(c+dx)}{bd^3} + \frac{3x^2 \sin(c+dx)}{bd^2} - \frac{x^3 \cos(c+dx)}{bd}$$

input
```
Int[(x^4*Sin[c + d*x])/(a + b*x),x]
```

output
```
(-2*a*Cos[c + d*x])/(b^2*d^3) + (a^3*Cos[c + d*x])/(b^4*d) + (6*x*Cos[c +
d*x])/(b*d^3) - (a^2*x*Cos[c + d*x])/(b^3*d) + (a*x^2*Cos[c + d*x])/(b^2*d
) - (x^3*Cos[c + d*x])/(b*d) + (a^4*CosIntegral[(a*d)/b + d*x]*Sin[c - (a*
d)/b])/b^5 - (6*Sin[c + d*x])/(b*d^4) + (a^2*Sin[c + d*x])/(b^3*d^2) - (2*
a*x*Sin[c + d*x])/(b^2*d^2) + (3*x^2*Sin[c + d*x])/(b*d^2) + (a^4*Cos[c -
(a*d)/b]*SinIntegral[(a*d)/b + d*x])/b^5
```

### 3.18.3.1 Defintions of rubi rules used

rule 2009
```
Int[u_, x_Symbol] :> Simp[IntSum[u, x], x] /; SumQ[u]
```

rule 7293
```
Int[u_, x_Symbol] :> With[{v = ExpandIntegrand[u, x]}, Int[v, x] /; SumQ[v]
]
```

## 3.18.4 Maple [C] (warning: unable to verify)

Result contains higher order function than in optimal. Order 9 vs. order 4.

Time = 0.42 (sec) , antiderivative size = 328, normalized size of antiderivative = 1.50

| method | result |
|---|---|
| risch | $-\frac{i\pi\,\mathrm{csgn}\left(\frac{d(bx+a)}{b}\right)\sin\left(\frac{da-cb}{b}\right)a^4}{2b^5}-\frac{x^3\cos(dx+c)}{bd}-\frac{\pi\,\mathrm{csgn}\left(\frac{d(bx+a)}{b}\right)\cos\left(\frac{da-cb}{b}\right)a^4}{2b^5}+\frac{i\,\mathrm{Si}\left(\frac{d(bx+a)}{b}\right)\sin\left(\frac{da-}{b}\right.}{b^5}$ |
| derivativedivides | $\frac{d\,c^4\left(\frac{\mathrm{Si}\left(dx+c+\frac{da-cb}{b}\right)\cos\left(\frac{da-cb}{b}\right)}{b}-\frac{\mathrm{Ci}\left(dx+c+\frac{da-cb}{b}\right)\sin\left(\frac{da-cb}{b}\right)}{b}\right)+\frac{4(da-cb)d\,c^3\left(\frac{\mathrm{Si}\left(dx+c+\frac{da-cb}{b}\right)\cos\left(\frac{da-cb}{b}\right)}{b}-\frac{\mathrm{Ci}(dx}{}\right.}{b}}{}$ |
| default | $\frac{d\,c^4\left(\frac{\mathrm{Si}\left(dx+c+\frac{da-cb}{b}\right)\cos\left(\frac{da-cb}{b}\right)}{b}-\frac{\mathrm{Ci}\left(dx+c+\frac{da-cb}{b}\right)\sin\left(\frac{da-cb}{b}\right)}{b}\right)+\frac{4(da-cb)d\,c^3\left(\frac{\mathrm{Si}\left(dx+c+\frac{da-cb}{b}\right)\cos\left(\frac{da-cb}{b}\right)}{b}-\frac{\mathrm{Ci}(dx}{}\right.}{b}}{}$ |

input
```
int(x^4*sin(d*x+c)/(b*x+a),x,method=_RETURNVERBOSE)
```

output
```
-1/2*I/b^5*Pi*csgn(d*(b*x+a)/b)*sin((a*d-b*c)/b)*a^4-x^3*cos(d*x+c)/b/d-1/
2/b^5*Pi*csgn(d*(b*x+a)/b)*cos((a*d-b*c)/b)*a^4+I/b^5*Si(d*(b*x+a)/b)*sin(
(a*d-b*c)/b)*a^4+a*x^2*cos(d*x+c)/b^2/d+1/b^5*Si(d*(b*x+a)/b)*cos((a*d-b*c
)/b)*a^4+1/b^5*Ei(1,-I*d*(b*x+a)/b)*sin((a*d-b*c)/b)*a^4+3*x^2*sin(d*x+c)/
b/d^2-a^2*x*cos(d*x+c)/b^3/d-2*a*x*sin(d*x+c)/b^2/d^2+a^3*cos(d*x+c)/b^4/d
+a^2*sin(d*x+c)/b^3/d^2+6*x*cos(d*x+c)/b/d^3-2*a*cos(d*x+c)/b^2/d^3-6*sin(
d*x+c)/b/d^4
```

## 3.18.5 Fricas [A] (verification not implemented)

Time = 0.27 (sec) , antiderivative size = 188, normalized size of antiderivative = 0.86

$$\int \frac{x^4\sin(c+dx)}{a+bx}\,dx = -\frac{a^4d^4\operatorname{Ci}\left(\frac{bdx+ad}{b}\right)\sin\left(-\frac{bc-ad}{b}\right)-a^4d^4\cos\left(-\frac{bc-ad}{b}\right)\operatorname{Si}\left(\frac{bdx+ad}{b}\right)+\left(b^4d^3x^3-ab^3d^3x^2-a^3bd^3+2\,ab^3d+(\right.}{b^5d^4}$$

input
```
integrate(x^4*sin(d*x+c)/(b*x+a),x, algorithm="fricas")
```

output
```
-(a^4*d^4*cos_integral((b*d*x + a*d)/b)*sin(-(b*c - a*d)/b) - a^4*d^4*cos(
-(b*c - a*d)/b)*sin_integral((b*d*x + a*d)/b) + (b^4*d^3*x^3 - a*b^3*d^3*x
^2 - a^3*b*d^3 + 2*a*b^3*d + (a^2*b^2*d^3 - 6*b^4*d)*x)*cos(d*x + c) - (3*
b^4*d^2*x^2 - 2*a*b^3*d^2*x + a^2*b^2*d^2 - 6*b^4)*sin(d*x + c))/(b^5*d^4)
```

## 3.18.6 Sympy [F]

$$\int \frac{x^4\sin(c+dx)}{a+bx}\,dx = \int \frac{x^4\sin\left(c+dx\right)}{a+bx}\,dx$$

input
```
integrate(x**4*sin(d*x+c)/(b*x+a),x)
```

output
```
Integral(x**4*sin(c + d*x)/(a + b*x), x)
```

### 3.18.7 Maxima [F]

$$\int \frac{x^4 \sin(c + dx)}{a + bx} \, dx = \int \frac{x^4 \sin(dx + c)}{bx + a} \, dx$$

input
```
integrate(x^4*sin(d*x+c)/(b*x+a),x, algorithm="maxima")
```

output
```
-1/2*(((6*a*b^2*(I*exp_integral_e(2, (I*b*d*x + I*a*d)/b) - I*exp_integral
_e(2, -(I*b*d*x + I*a*d)/b))*cos(c)^2 + 6*a*b^2*(I*exp_integral_e(2, (I*b*
d*x + I*a*d)/b) - I*exp_integral_e(2, -(I*b*d*x + I*a*d)/b))*sin(c)^2 - (a
^3*(-I*exp_integral_e(2, (I*b*d*x + I*a*d)/b) + I*exp_integral_e(2, -(I*b*
d*x + I*a*d)/b))*cos(c)^2 + a^3*(-I*exp_integral_e(2, (I*b*d*x + I*a*d)/b)
 + I*exp_integral_e(2, -(I*b*d*x + I*a*d)/b))*sin(c)^2)*d^2 - 4*(a^2*b*(ex
p_integral_e(2, (I*b*d*x + I*a*d)/b) + exp_integral_e(2, -(I*b*d*x + I*a*d
)/b))*cos(c)^2 + a^2*b*(exp_integral_e(2, (I*b*d*x + I*a*d)/b) + exp_integ
ral_e(2, -(I*b*d*x + I*a*d)/b))*sin(c)^2)*d)*cos(-(b*c - a*d)/b) - (6*a*b^
2*(exp_integral_e(2, (I*b*d*x + I*a*d)/b) + exp_integral_e(2, -(I*b*d*x +
I*a*d)/b))*cos(c)^2 + 6*a*b^2*(exp_integral_e(2, (I*b*d*x + I*a*d)/b) + ex
p_integral_e(2, -(I*b*d*x + I*a*d)/b))*sin(c)^2 + (a^3*(exp_integral_e(2,
(I*b*d*x + I*a*d)/b) + exp_integral_e(2, -(I*b*d*x + I*a*d)/b))*cos(c)^2 +
 a^3*(exp_integral_e(2, (I*b*d*x + I*a*d)/b) + exp_integral_e(2, -(I*b*d*x
 + I*a*d)/b))*sin(c)^2)*d^2 - 4*(a^2*b*(-I*exp_integral_e(2, (I*b*d*x + I*
a*d)/b) + I*exp_integral_e(2, -(I*b*d*x + I*a*d)/b))*cos(c)^2 + a^2*b*(-I*
exp_integral_e(2, (I*b*d*x + I*a*d)/b) + I*exp_integral_e(2, -(I*b*d*x + I
*a*d)/b))*sin(c)^2)*d)*sin(-(b*c - a*d)/b))*cos(d*x + c)^2 + ((6*a*b^2*(I*
exp_integral_e(2, (I*b*d*x + I*a*d)/b) - I*exp_integral_e(2, -(I*b*d*x + I
*a*d)/b))*cos(c)^2 + 6*a*b^2*(I*exp_integral_e(2, (I*b*d*x + I*a*d)/b) ...
```

### 3.18.8 Giac [C] (verification not implemented)

Result contains higher order function than in optimal. Order 9 vs. order 4.

Time = 0.36 (sec) , antiderivative size = 3337, normalized size of antiderivative = 15.31

$$\int \frac{x^4 \sin(c + dx)}{a + bx} \, dx = \text{Too large to display}$$

input
```
integrate(x^4*sin(d*x+c)/(b*x+a),x, algorithm="giac")
```

output
```
1/2*(2*b^4*d^3*x^3*tan(1/2*d*x + 1/2*c)^2*tan(1/2*c)^2*tan(1/2*a*d/b)^2 -
2*a*b^3*d^3*x^2*tan(1/2*d*x + 1/2*c)^2*tan(1/2*c)^2*tan(1/2*a*d/b)^2 + a^4
*d^4*imag_part(cos_integral(d*x + a*d/b))*tan(1/2*d*x + 1/2*c)^2*tan(1/2*c
)^2*tan(1/2*a*d/b)^2 - a^4*d^4*imag_part(cos_integral(-d*x - a*d/b))*tan(1
/2*d*x + 1/2*c)^2*tan(1/2*c)^2*tan(1/2*a*d/b)^2 + 2*a^4*d^4*sin_integral((
b*d*x + a*d)/b)*tan(1/2*d*x + 1/2*c)^2*tan(1/2*c)^2*tan(1/2*a*d/b)^2 + 2*b
^4*d^3*x^3*tan(1/2*d*x + 1/2*c)^2*tan(1/2*c)^2 + 2*a^4*d^4*real_part(cos_i
ntegral(d*x + a*d/b))*tan(1/2*d*x + 1/2*c)^2*tan(1/2*c)^2*tan(1/2*a*d/b) +
 2*a^4*d^4*real_part(cos_integral(-d*x - a*d/b))*tan(1/2*d*x + 1/2*c)^2*ta
n(1/2*c)^2*tan(1/2*a*d/b) + 2*b^4*d^3*x^3*tan(1/2*d*x + 1/2*c)^2*tan(1/2*a
*d/b)^2 - 2*a^4*d^4*real_part(cos_integral(d*x + a*d/b))*tan(1/2*d*x + 1/2
*c)^2*tan(1/2*c)*tan(1/2*a*d/b)^2 - 2*a^4*d^4*real_part(cos_integral(-d*x
- a*d/b))*tan(1/2*d*x + 1/2*c)^2*tan(1/2*c)*tan(1/2*a*d/b)^2 - 2*b^4*d^3*x
^3*tan(1/2*c)^2*tan(1/2*a*d/b)^2 + 2*a^2*b^2*d^3*x*tan(1/2*d*x + 1/2*c)^2*
tan(1/2*c)^2*tan(1/2*a*d/b)^2 - 2*a*b^3*d^3*x^2*tan(1/2*d*x + 1/2*c)^2*tan
(1/2*c)^2 - a^4*d^4*imag_part(cos_integral(d*x + a*d/b))*tan(1/2*d*x + 1/2
*c)^2*tan(1/2*c)^2 + a^4*d^4*imag_part(cos_integral(-d*x - a*d/b))*tan(1/2
*d*x + 1/2*c)^2*tan(1/2*c)^2 - 2*a^4*d^4*sin_integral((b*d*x + a*d)/b)*tan
(1/2*d*x + 1/2*c)^2*tan(1/2*c)^2 + 4*a^4*d^4*imag_part(cos_integral(d*x +
a*d/b))*tan(1/2*d*x + 1/2*c)^2*tan(1/2*c)*tan(1/2*a*d/b) - 4*a^4*d^4*im...
```

### 3.18.9 Mupad [F(-1)]

Timed out.

$$\int \frac{x^4\sin(c+dx)}{a+bx}\,dx=\int \frac{x^4\,\sin\left(c+d\,x\right)}{a+b\,x}\,dx$$

input
```
int((x^4*sin(c + d*x))/(a + b*x),x)
```

output
```
int((x^4*sin(c + d*x))/(a + b*x), x)
```

# 3.19 $\int \frac{x^3 \sin(c+dx)}{a+bx}\,dx$



## 3.19.1 Optimal result

Integrand size = 17, antiderivative size = 152

$$\int \frac{x^3 \sin(c+dx)}{a+bx}\,dx = \frac{2\cos(c+dx)}{bd^3} - \frac{a^2\cos(c+dx)}{b^3d} + \frac{ax\cos(c+dx)}{b^2d} - \frac{x^2\cos(c+dx)}{bd} - \frac{a^3\,\text{CosIntegral}\left(\frac{ad}{b}+dx\right)\sin\left(c-\frac{ad}{b}\right)}{b^4} - \frac{a\sin(c+dx)}{b^2d^2} + \frac{2x\sin(c+dx)}{bd^2} - \frac{a^3\cos\left(c-\frac{ad}{b}\right)\text{Si}\left(\frac{ad}{b}+dx\right)}{b^4}$$

output
```
2*cos(d*x+c)/b/d^3-a^2*cos(d*x+c)/b^3/d+a*x*cos(d*x+c)/b^2/d-x^2*cos(d*x+c
)/b/d-a^3*cos(-c+a*d/b)*Si(a*d/b+d*x)/b^4+a^3*Ci(a*d/b+d*x)*sin(-c+a*d/b)/
b^4-a*sin(d*x+c)/b^2/d^2+2*x*sin(d*x+c)/b/d^2
```

## 3.19.2 Mathematica [A] (verified)

Time = 0.35 (sec) , antiderivative size = 117, normalized size of antiderivative = 0.77

$$\int \frac{x^3 \sin(c+dx)}{a+bx}\,dx = -\frac{a^3d^3\,\text{CosIntegral}\left(d\left(\frac{a}{b}+x\right)\right)\sin\left(c-\frac{ad}{b}\right) + b((a^2d^2-abd^2x+b^2(-2+d^2x^2))\cos(c+dx)+bd(a-2bx}{b^4d^3}$$

input
```
Integrate[(x^3*Sin[c + d*x])/(a + b*x),x]
```

output
```
-((a^3*d^3*CosIntegral[d*(a/b + x)]*Sin[c - (a*d)/b] + b*((a^2*d^2 - a*b*d
^2*x + b^2*(-2 + d^2*x^2))*Cos[c + d*x] + b*d*(a - 2*b*x)*Sin[c + d*x]) +
a^3*d^3*Cos[c - (a*d)/b]*SinIntegral[d*(a/b + x)])/(b^4*d^3))
```

### 3.19.3 Rubi [A] (verified)

Time = 0.50 (sec) , antiderivative size = 152, normalized size of antiderivative = 1.00, number of steps used = 2, number of rules used = 2, $\frac{\text{number of rules}}{\text{integrand size}} = 0.118$, Rules used = {7293, 2009}

Below are the steps used by Rubi to obtain the solution. The rule number used for the transformation is given above next to the arrow. The rules definitions used are listed below.

$$\int \frac{x^3 \sin(c+dx)}{a+bx} \, dx$$

$$\Big\downarrow \text{7293}$$

$$\int \left(-\frac{a^3 \sin(c+dx)}{b^3(a+bx)}+\frac{a^2 \sin(c+dx)}{b^3}-\frac{ax \sin(c+dx)}{b^2}+\frac{x^2 \sin(c+dx)}{b}\right)dx$$

$$\Big\downarrow \text{2009}$$

$$-\frac{a^3 \sin\left(c-\frac{ad}{b}\right) \text{CosIntegral}\left(xd+\frac{ad}{b}\right)}{b^4}-\frac{a^3 \cos\left(c-\frac{ad}{b}\right) \text{Si}\left(xd+\frac{ad}{b}\right)}{b^4}-\frac{a^2 \cos(c+dx)}{b^3 d}-\frac{a \sin(c+dx)}{b^2 d^2}+\frac{ax \cos(c+dx)}{b^2 d}+\frac{2 \cos(c+dx)}{bd^3}+\frac{2x \sin(c+dx)}{bd^2}-\frac{x^2 \cos(c+dx)}{bd}$$

input
```
Int[(x^3*Sin[c + d*x])/(a + b*x),x]
```

output
```
(2*Cos[c + d*x])/(b*d^3) - (a^2*Cos[c + d*x])/(b^3*d) + (a*x*Cos[c + d*x])
/(b^2*d) - (x^2*Cos[c + d*x])/(b*d) - (a^3*CosIntegral[(a*d)/b + d*x]*Sin[
c - (a*d)/b])/b^4 - (a*Sin[c + d*x])/(b^2*d^2) + (2*x*Sin[c + d*x])/(b*d^2
) - (a^3*Cos[c - (a*d)/b]*SinIntegral[(a*d)/b + d*x])/b^4
```

#### 3.19.3.1 Defintions of rubi rules used

rule 2009
```
Int[u_, x_Symbol] :> Simp[IntSum[u, x], x] /; SumQ[u]
```

rule 7293
```
Int[u_, x_Symbol] :> With[{v = ExpandIntegrand[u, x]}, Int[v, x] /; SumQ[v]
]
```

### 3.19.4 Maple [C] (verified)

Result contains complex when optimal does not.

Time = 0.32 (sec) , antiderivative size = 237, normalized size of antiderivative = 1.56

| method | result |
|---|---|
| risch | $\frac{i \operatorname{Ei}_1\left(\frac{id(bx+a)}{b}\right)\cos\left(\frac{da-cb}{b}\right)a^3}{2b^4} - \frac{i \operatorname{Ei}_1\left(-\frac{id(bx+a)}{b}\right)\cos\left(\frac{da-cb}{b}\right)a^3}{2b^4} - \frac{x^2\cos(dx+c)}{bd} - \frac{\operatorname{Ei}_1\left(\frac{id(bx+a)}{b}\right)\sin\left(\frac{da-cb}{b}\right)}{2b^4}$ |
| derivativedivides | $-dc^3\left(\frac{\operatorname{Si}\left(dx+c+\frac{da-cb}{b}\right)\cos\left(\frac{da-cb}{b}\right)}{b} - \frac{\operatorname{Ci}\left(dx+c+\frac{da-cb}{b}\right)\sin\left(\frac{da-cb}{b}\right)}{b}\right) - \frac{3(da-cb)dc^2\left(\frac{\operatorname{Si}\left(dx+c+\frac{da-cb}{b}\right)\cos\left(\frac{da-cb}{b}\right)}{b} - \operatorname{Ci}\right.}{b}$ |
| default | $-dc^3\left(\frac{\operatorname{Si}\left(dx+c+\frac{da-cb}{b}\right)\cos\left(\frac{da-cb}{b}\right)}{b} - \frac{\operatorname{Ci}\left(dx+c+\frac{da-cb}{b}\right)\sin\left(\frac{da-cb}{b}\right)}{b}\right) - \frac{3(da-cb)dc^2\left(\frac{\operatorname{Si}\left(dx+c+\frac{da-cb}{b}\right)\cos\left(\frac{da-cb}{b}\right)}{b} - \operatorname{Ci}\right.}{b}$ |

input
```
int(x^3*sin(d*x+c)/(b*x+a),x,method=_RETURNVERBOSE)
```

output
```
1/2*I/b^4*Ei(1,I*d*(b*x+a)/b)*cos((a*d-b*c)/b)*a^3-1/2*I/b^4*Ei(1,-I*d*(b*
x+a)/b)*cos((a*d-b*c)/b)*a^3-x^2*cos(d*x+c)/b/d-1/2/b^4*Ei(1,I*d*(b*x+a)/b
)*sin((a*d-b*c)/b)*a^3-1/2/b^4*Ei(1,-I*d*(b*x+a)/b)*sin((a*d-b*c)/b)*a^3+a
*x*cos(d*x+c)/b^2/d+2*x*sin(d*x+c)/b/d^2-a^2*cos(d*x+c)/b^3/d-a*sin(d*x+c)
/b^2/d^2+2*cos(d*x+c)/b/d^3
```

### 3.19.5 Fricas [A] (verification not implemented)

Time = 0.29 (sec) , antiderivative size = 141, normalized size of antiderivative = 0.93

$$\int \frac{x^3 \sin(c+dx)}{a+bx} \, dx = \frac{a^3 d^3 \operatorname{Ci}\left(\frac{bdx+ad}{b}\right) \sin\left(-\frac{bc-ad}{b}\right) - a^3 d^3 \cos\left(-\frac{bc-ad}{b}\right) \operatorname{Si}\left(\frac{bdx+ad}{b}\right) - (b^3 d^2 x^2 - ab^2 d^2 x + a^2 b d^2 - 2\,b^3) \cos(dx +}{b^4 d^3}$$

input
```
integrate(x^3*sin(d*x+c)/(b*x+a),x, algorithm="fricas")
```

output
```
(a^3*d^3*cos_integral((b*d*x + a*d)/b)*sin(-(b*c - a*d)/b) - a^3*d^3*cos(-
(b*c - a*d)/b)*sin_integral((b*d*x + a*d)/b) - (b^3*d^2*x^2 - a*b^2*d^2*x
+ a^2*b*d^2 - 2*b^3)*cos(d*x + c) + (2*b^3*d*x - a*b^2*d)*sin(d*x + c))/(b
^4*d^3)
```

### 3.19.6 Sympy [F]

$$\int \frac{x^3 \sin(c+dx)}{a+bx} \, dx = \int \frac{x^3 \sin(c+dx)}{a+bx} \, dx$$

input
```
integrate(x**3*sin(d*x+c)/(b*x+a),x)
```

output
```
Integral(x**3*sin(c + d*x)/(a + b*x), x)
```

### 3.19.7 Maxima [F]

$$\int \frac{x^3 \sin(c+dx)}{a+bx} \, dx = \int \frac{x^3 \sin(dx+c)}{bx+a} \, dx$$

input
```
integrate(x^3*sin(d*x+c)/(b*x+a),x, algorithm="maxima")
```

output
```
1/2*(((2*a*b*(exp_integral_e(2, (I*b*d*x + I*a*d)/b) + exp_integral_e(2, -
(I*b*d*x + I*a*d)/b))*cos(c)^2 + 2*a*b*(exp_integral_e(2, (I*b*d*x + I*a*d
)/b) + exp_integral_e(2, -(I*b*d*x + I*a*d)/b))*sin(c)^2 - (a^2*(-I*exp_in
tegral_e(2, (I*b*d*x + I*a*d)/b) + I*exp_integral_e(2, -(I*b*d*x + I*a*d)/
b))*cos(c)^2 + a^2*(-I*exp_integral_e(2, (I*b*d*x + I*a*d)/b) + I*exp_inte
gral_e(2, -(I*b*d*x + I*a*d)/b))*sin(c)^2)*d)*cos(-(b*c - a*d)/b) + (2*a*b
*(I*exp_integral_e(2, (I*b*d*x + I*a*d)/b) - I*exp_integral_e(2, -(I*b*d*x
 + I*a*d)/b))*cos(c)^2 + 2*a*b*(I*exp_integral_e(2, (I*b*d*x + I*a*d)/b) -
 I*exp_integral_e(2, -(I*b*d*x + I*a*d)/b))*sin(c)^2 - (a^2*(exp_integral_
e(2, (I*b*d*x + I*a*d)/b) + exp_integral_e(2, -(I*b*d*x + I*a*d)/b))*cos(c
)^2 + a^2*(exp_integral_e(2, (I*b*d*x + I*a*d)/b) + exp_integral_e(2, -(I*
b*d*x + I*a*d)/b))*sin(c)^2)*d)*sin(-(b*c - a*d)/b))*cos(d*x + c)^2 + ((2*
a*b*(exp_integral_e(2, (I*b*d*x + I*a*d)/b) + exp_integral_e(2, -(I*b*d*x
+ I*a*d)/b))*cos(c)^2 + 2*a*b*(exp_integral_e(2, (I*b*d*x + I*a*d)/b) + ex
p_integral_e(2, -(I*b*d*x + I*a*d)/b))*sin(c)^2 - (a^2*(-I*exp_integral_e(
2, (I*b*d*x + I*a*d)/b) + I*exp_integral_e(2, -(I*b*d*x + I*a*d)/b))*cos(c
)^2 + a^2*(-I*exp_integral_e(2, (I*b*d*x + I*a*d)/b) + I*exp_integral_e(2,
 -(I*b*d*x + I*a*d)/b))*sin(c)^2)*d)*cos(-(b*c - a*d)/b) + (2*a*b*(I*exp_i
ntegral_e(2, (I*b*d*x + I*a*d)/b) - I*exp_integral_e(2, -(I*b*d*x + I*a*d)
/b))*cos(c)^2 + 2*a*b*(I*exp_integral_e(2, (I*b*d*x + I*a*d)/b) - I*exp...
```

### 3.19.8 Giac [C] (verification not implemented)

Result contains higher order function than in optimal. Order 9 vs. order 4.

Time = 0.34 (sec) , antiderivative size = 2709, normalized size of antiderivative = 17.82

$$\int \frac{x^3 \sin(c+dx)}{a+bx} \, dx = \text{Too large to display}$$

input
```
integrate(x^3*sin(d*x+c)/(b*x+a),x, algorithm="giac")
```

output
```
1/2*(2*b^3*d^2*x^2*tan(1/2*d*x + 1/2*c)^2*tan(1/2*c)^2*tan(1/2*a*d/b)^2 -
a^3*d^3*imag_part(cos_integral(d*x + a*d/b))*tan(1/2*d*x + 1/2*c)^2*tan(1/
2*c)^2*tan(1/2*a*d/b)^2 + a^3*d^3*imag_part(cos_integral(-d*x - a*d/b))*ta
n(1/2*d*x + 1/2*c)^2*tan(1/2*c)^2*tan(1/2*a*d/b)^2 - 2*a^3*d^3*sin_integra
l((b*d*x + a*d)/b)*tan(1/2*d*x + 1/2*c)^2*tan(1/2*c)^2*tan(1/2*a*d/b)^2 -
2*a^3*d^3*real_part(cos_integral(d*x + a*d/b))*tan(1/2*d*x + 1/2*c)^2*tan(
1/2*c)^2*tan(1/2*a*d/b) - 2*a^3*d^3*real_part(cos_integral(-d*x - a*d/b))*
tan(1/2*d*x + 1/2*c)^2*tan(1/2*c)^2*tan(1/2*a*d/b) + 2*a^3*d^3*real_part(c
os_integral(d*x + a*d/b))*tan(1/2*d*x + 1/2*c)^2*tan(1/2*c)*tan(1/2*a*d/b)
^2 + 2*a^3*d^3*real_part(cos_integral(-d*x - a*d/b))*tan(1/2*d*x + 1/2*c)^
2*tan(1/2*c)*tan(1/2*a*d/b)^2 - 2*a*b^2*d^2*x*tan(1/2*d*x + 1/2*c)^2*tan(1
/2*c)^2*tan(1/2*a*d/b)^2 + 2*b^3*d^2*x^2*tan(1/2*d*x + 1/2*c)^2*tan(1/2*c)
^2 + a^3*d^3*imag_part(cos_integral(d*x + a*d/b))*tan(1/2*d*x + 1/2*c)^2*t
an(1/2*c)^2 - a^3*d^3*imag_part(cos_integral(-d*x - a*d/b))*tan(1/2*d*x +
1/2*c)^2*tan(1/2*c)^2 + 2*a^3*d^3*sin_integral((b*d*x + a*d)/b)*tan(1/2*d*
x + 1/2*c)^2*tan(1/2*c)^2 - 4*a^3*d^3*imag_part(cos_integral(d*x + a*d/b))
*tan(1/2*d*x + 1/2*c)^2*tan(1/2*c)*tan(1/2*a*d/b) + 4*a^3*d^3*imag_part(co
s_integral(-d*x - a*d/b))*tan(1/2*d*x + 1/2*c)^2*tan(1/2*c)*tan(1/2*a*d/b)
 - 8*a^3*d^3*sin_integral((b*d*x + a*d)/b)*tan(1/2*d*x + 1/2*c)^2*tan(1/2*
c)*tan(1/2*a*d/b) + 2*b^3*d^2*x^2*tan(1/2*d*x + 1/2*c)^2*tan(1/2*a*d/b)...
```

### 3.19.9 Mupad [F(-1)]

Timed out.

$$\int \frac{x^3\sin(c+dx)}{a+bx}\,dx=\int \frac{x^3\,\sin\left(c+d\,x\right)}{a+b\,x}\,dx$$

input
```
int((x^3*sin(c + d*x))/(a + b*x),x)
```

output
```
int((x^3*sin(c + d*x))/(a + b*x), x)
```

# 3.20 $\int \frac{x^2 \sin(c+dx)}{a+bx} \, dx$



## 3.20.1 Optimal result

Integrand size = 17, antiderivative size = 99

$$\int \frac{x^2 \sin(c+dx)}{a+bx} \, dx = \frac{a\cos(c+dx)}{b^2 d} - \frac{x\cos(c+dx)}{bd} + \frac{a^2 \operatorname{CosIntegral}\left(\frac{ad}{b}+dx\right)\sin\left(c-\frac{ad}{b}\right)}{b^3} + \frac{\sin(c+dx)}{bd^2} + \frac{a^2\cos\left(c-\frac{ad}{b}\right)\operatorname{Si}\left(\frac{ad}{b}+dx\right)}{b^3}$$

output
```
a*cos(d*x+c)/b^2/d-x*cos(d*x+c)/b/d+a^2*cos(-c+a*d/b)*Si(a*d/b+d*x)/b^3-a^
2*Ci(a*d/b+d*x)*sin(-c+a*d/b)/b^3+sin(d*x+c)/b/d^2
```

## 3.20.2 Mathematica [A] (verified)

Time = 0.19 (sec) , antiderivative size = 87, normalized size of antiderivative = 0.88

$$\int \frac{x^2 \sin(c+dx)}{a+bx} \, dx = \frac{a^2 d^2 \operatorname{CosIntegral}\left(d\left(\frac{a}{b}+x\right)\right)\sin\left(c-\frac{ad}{b}\right) + b(d(a-bx)\cos(c+dx) + b\sin(c+dx)) + a^2 d^2 \cos\left(c-\frac{ad}{b}\right) \operatorname{Si}}{b^3 d^2}$$

input
```
Integrate[(x^2*Sin[c + d*x])/(a + b*x),x]
```

output
```
(a^2*d^2*CosIntegral[d*(a/b + x)]*Sin[c - (a*d)/b] + b*(d*(a - b*x)*Cos[c
+ d*x] + b*Sin[c + d*x]) + a^2*d^2*Cos[c - (a*d)/b]*SinIntegral[d*(a/b + x
)])/(b^3*d^2)
```

### 3.20.3 Rubi [A] (verified)

Time = 0.43 (sec) , antiderivative size = 99, normalized size of antiderivative = 1.00, number of steps used = 2, number of rules used = 2, $\frac{\text{number of rules}}{\text{integrand size}}$ = 0.118, Rules used = {7293, 2009}

Below are the steps used by Rubi to obtain the solution. The rule number used for the transformation is given above next to the arrow. The rules definitions used are listed below.

$$\int \frac{x^2 \sin(c+dx)}{a+bx} \, dx$$

$$\Big\downarrow \; 7293$$

$$\int \left(\frac{a^2 \sin(c+dx)}{b^2(a+bx)}-\frac{a \sin(c+dx)}{b^2}+\frac{x \sin(c+dx)}{b}\right)dx$$

$$\Big\downarrow \; 2009$$

$$\frac{a^2 \sin\left(c-\frac{ad}{b}\right) \text{CosIntegral}\left(xd+\frac{ad}{b}\right)}{b^3}+\frac{a^2 \cos\left(c-\frac{ad}{b}\right) \text{Si}\left(xd+\frac{ad}{b}\right)}{b^3}+\frac{a \cos(c+dx)}{b^2 d}+\frac{\sin(c+dx)}{bd^2}-\frac{x \cos(c+dx)}{bd}$$

input
```
Int[(x^2*Sin[c + d*x])/(a + b*x),x]
```

output
```
(a*Cos[c + d*x])/(b^2*d) - (x*Cos[c + d*x])/(b*d) + (a^2*CosIntegral[(a*d)
/b + d*x]*Sin[c - (a*d)/b])/b^3 + Sin[c + d*x]/(b*d^2) + (a^2*Cos[c - (a*d
)/b]*SinIntegral[(a*d)/b + d*x])/b^3
```

#### 3.20.3.1 Defintions of rubi rules used

rule 2009
```
Int[u_, x_Symbol] :> Simp[IntSum[u, x], x] /; SumQ[u]
```

rule 7293
```
Int[u_, x_Symbol] :> With[{v = ExpandIntegrand[u, x]}, Int[v, x] /; SumQ[v]
]
```

### 3.20.4 Maple [C] (verified)

Result contains complex when optimal does not.

Time = 0.27 (sec) , antiderivative size = 180, normalized size of antiderivative = 1.82

| method | result |
|---|---|
| risch | $-\frac{(dxb-da)\cos(dx+c)}{d^2b^2}+\frac{\sin(dx+c)}{b\,d^2}-\frac{ia^2\cos\left(\frac{da-cb}{b}\right)\mathrm{Ei}_1\left(\frac{id(bx+a)}{b}\right)}{2b^3}+\frac{ia^2\cos\left(\frac{da-cb}{b}\right)\mathrm{Ei}_1\left(-\frac{id(bx+a)}{b}\right)}{2b^3}+\frac{a^2 \ldots}{}$ |
| derivativedivides | $\frac{c^2d\left(\frac{\mathrm{Si}\left(dx+c+\frac{da-cb}{b}\right)\cos\left(\frac{da-cb}{b}\right)}{b}-\frac{\mathrm{Ci}\left(dx+c+\frac{da-cb}{b}\right)\sin\left(\frac{da-cb}{b}\right)}{b}\right)+\frac{2(da-cb)cd\left(\frac{\mathrm{Si}\left(dx+c+\frac{da-cb}{b}\right)\cos\left(\frac{da-cb}{b}\right)}{b}-\mathrm{Ci}(dx+\ldots\right.}{b}}{}$ |
| default | $\frac{c^2d\left(\frac{\mathrm{Si}\left(dx+c+\frac{da-cb}{b}\right)\cos\left(\frac{da-cb}{b}\right)}{b}-\frac{\mathrm{Ci}\left(dx+c+\frac{da-cb}{b}\right)\sin\left(\frac{da-cb}{b}\right)}{b}\right)+\frac{2(da-cb)cd\left(\frac{\mathrm{Si}\left(dx+c+\frac{da-cb}{b}\right)\cos\left(\frac{da-cb}{b}\right)}{b}-\mathrm{Ci}(dx+\ldots\right.}{b}}{}$ |

input
```
int(x^2*sin(d*x+c)/(b*x+a),x,method=_RETURNVERBOSE)
```

output
```
-1/d^2*(b*d*x-a*d)/b^2*cos(d*x+c)+sin(d*x+c)/b/d^2-1/2*I*a^2/b^3*cos((a*d-
b*c)/b)*Ei(1,I*d*(b*x+a)/b)+1/2*I*a^2/b^3*cos((a*d-b*c)/b)*Ei(1,-I*d*(b*x+
a)/b)+1/2*a^2/b^3*sin((a*d-b*c)/b)*Ei(1,I*d*(b*x+a)/b)+1/2*a^2/b^3*sin((a*
d-b*c)/b)*Ei(1,-I*d*(b*x+a)/b)
```

### 3.20.5 Fricas [A] (verification not implemented)

Time = 0.28 (sec) , antiderivative size = 108, normalized size of antiderivative = 1.09

$$\int\frac{x^2\sin(c+dx)}{a+bx}\,dx = -\frac{a^2d^2\,\mathrm{Ci}\left(\frac{bdx+ad}{b}\right)\sin\left(-\frac{bc-ad}{b}\right)-a^2d^2\cos\left(-\frac{bc-ad}{b}\right)\mathrm{Si}\left(\frac{bdx+ad}{b}\right)-b^2\sin(dx+c)+(b^2dx-abd)\cos(dx+\ldots}{b^3d^2}$$

input
```
integrate(x^2*sin(d*x+c)/(b*x+a),x, algorithm="fricas")
```

output
```
-(a^2*d^2*cos_integral((b*d*x + a*d)/b)*sin(-(b*c - a*d)/b) - a^2*d^2*cos(
-(b*c - a*d)/b)*sin_integral((b*d*x + a*d)/b) - b^2*sin(d*x + c) + (b^2*d*
x - a*b*d)*cos(d*x + c))/(b^3*d^2)
```

### 3.20.6 Sympy [F]

$$\int \frac{x^2 \sin(c+dx)}{a+bx} \, dx = \int \frac{x^2 \sin(c+dx)}{a+bx} \, dx$$

input
```
integrate(x**2*sin(d*x+c)/(b*x+a),x)
```

output
```
Integral(x**2*sin(c + d*x)/(a + b*x), x)
```

### 3.20.7 Maxima [F]

$$\int \frac{x^2 \sin(c+dx)}{a+bx} \, dx = \int \frac{x^2 \sin(dx+c)}{bx+a} \, dx$$

input
```
integrate(x^2*sin(d*x+c)/(b*x+a),x, algorithm="maxima")
```

output
```
-1/2*((b*cos(c)^2 + b*sin(c)^2)*d*x^2*cos(d*x + c) - ((a*(I*exp_integral_e
(2, (I*b*d*x + I*a*d)/b) - I*exp_integral_e(2, -(I*b*d*x + I*a*d)/b))*cos(
c)^2 + a*(I*exp_integral_e(2, (I*b*d*x + I*a*d)/b) - I*exp_integral_e(2, -
(I*b*d*x + I*a*d)/b))*sin(c)^2)*cos(-(b*c - a*d)/b) - (a*(exp_integral_e(2
, (I*b*d*x + I*a*d)/b) + exp_integral_e(2, -(I*b*d*x + I*a*d)/b))*cos(c)^2
 + a*(exp_integral_e(2, (I*b*d*x + I*a*d)/b) + exp_integral_e(2, -(I*b*d*x
 + I*a*d)/b))*sin(c)^2)*sin(-(b*c - a*d)/b))*cos(d*x + c)^2 - (b*cos(c)^2
+ b*sin(c)^2)*x*sin(d*x + c) - ((a*(I*exp_integral_e(2, (I*b*d*x + I*a*d)/
b) - I*exp_integral_e(2, -(I*b*d*x + I*a*d)/b))*cos(c)^2 + a*(I*exp_integr
al_e(2, (I*b*d*x + I*a*d)/b) - I*exp_integral_e(2, -(I*b*d*x + I*a*d)/b))*
sin(c)^2)*cos(-(b*c - a*d)/b) - (a*(exp_integral_e(2, (I*b*d*x + I*a*d)/b)
 + exp_integral_e(2, -(I*b*d*x + I*a*d)/b))*cos(c)^2 + a*(exp_integral_e(2
, (I*b*d*x + I*a*d)/b) + exp_integral_e(2, -(I*b*d*x + I*a*d)/b))*sin(c)^2
)*sin(-(b*c - a*d)/b))*sin(d*x + c)^2 + ((b*d*x^2*cos(c) + b*x*sin(c))*cos
(d*x + c)^2 + (b*d*x^2*cos(c) + b*x*sin(c))*sin(d*x + c)^2)*cos(d*x + 2*c)
 - 2*(((a*b^2*cos(c)^2 + a*b^2*sin(c)^2)*d^3*x + (a^2*b*cos(c)^2 + a^2*b*s
in(c)^2)*d^3)*cos(d*x + c)^2 + ((a*b^2*cos(c)^2 + a*b^2*sin(c)^2)*d^3*x +
(a^2*b*cos(c)^2 + a^2*b*sin(c)^2)*d^3)*sin(d*x + c)^2)*integrate(1/2*x*cos
(d*x + c)/(b^2*d^2*x^2 + 2*a*b*d^2*x + a^2*d^2), x) - 2*(((a*b^2*cos(c)^2
+ a*b^2*sin(c)^2)*d^3*x + (a^2*b*cos(c)^2 + a^2*b*sin(c)^2)*d^3)*cos(d*...
```

### 3.20.8 Giac [C] (verification not implemented)

Result contains higher order function than in optimal. Order 9 vs. order 4.

Time = 0.35 (sec) , antiderivative size = 2205, normalized size of antiderivative = 22.27

$$\int \frac{x^2 \sin(c + dx)}{a + bx} dx = \text{Too large to display}$$

input
```
integrate(x^2*sin(d*x+c)/(b*x+a),x, algorithm="giac")
```

output
```
1/2*(a^2*d^2*imag_part(cos_integral(d*x + a*d/b))*tan(1/2*d*x + 1/2*c)^2*t
an(1/2*c)^2*tan(1/2*a*d/b)^2 - a^2*d^2*imag_part(cos_integral(-d*x - a*d/b
))*tan(1/2*d*x + 1/2*c)^2*tan(1/2*c)^2*tan(1/2*a*d/b)^2 + 2*a^2*d^2*sin_in
tegral((b*d*x + a*d)/b)*tan(1/2*d*x + 1/2*c)^2*tan(1/2*c)^2*tan(1/2*a*d/b)
^2 + 2*a^2*d^2*real_part(cos_integral(d*x + a*d/b))*tan(1/2*d*x + 1/2*c)^2
*tan(1/2*c)^2*tan(1/2*a*d/b) + 2*a^2*d^2*real_part(cos_integral(-d*x - a*d
/b))*tan(1/2*d*x + 1/2*c)^2*tan(1/2*c)^2*tan(1/2*a*d/b) - 2*a^2*d^2*real_p
art(cos_integral(d*x + a*d/b))*tan(1/2*d*x + 1/2*c)^2*tan(1/2*c)*tan(1/2*a
*d/b)^2 - 2*a^2*d^2*real_part(cos_integral(-d*x - a*d/b))*tan(1/2*d*x + 1/
2*c)^2*tan(1/2*c)*tan(1/2*a*d/b)^2 + 2*b^2*d*x*tan(1/2*d*x + 1/2*c)^2*tan(
1/2*c)^2*tan(1/2*a*d/b)^2 - a^2*d^2*imag_part(cos_integral(d*x + a*d/b))*t
an(1/2*d*x + 1/2*c)^2*tan(1/2*c)^2 + a^2*d^2*imag_part(cos_integral(-d*x -
 a*d/b))*tan(1/2*d*x + 1/2*c)^2*tan(1/2*c)^2 - 2*a^2*d^2*sin_integral((b*d
*x + a*d)/b)*tan(1/2*d*x + 1/2*c)^2*tan(1/2*c)^2 + 4*a^2*d^2*imag_part(cos
_integral(d*x + a*d/b))*tan(1/2*d*x + 1/2*c)^2*tan(1/2*c)*tan(1/2*a*d/b) -
 4*a^2*d^2*imag_part(cos_integral(-d*x - a*d/b))*tan(1/2*d*x + 1/2*c)^2*ta
n(1/2*c)*tan(1/2*a*d/b) + 8*a^2*d^2*sin_integral((b*d*x + a*d)/b)*tan(1/2*
d*x + 1/2*c)^2*tan(1/2*c)*tan(1/2*a*d/b) - a^2*d^2*imag_part(cos_integral(
d*x + a*d/b))*tan(1/2*d*x + 1/2*c)^2*tan(1/2*a*d/b)^2 + a^2*d^2*imag_part(
cos_integral(-d*x - a*d/b))*tan(1/2*d*x + 1/2*c)^2*tan(1/2*a*d/b)^2 - 2...
```

### 3.20.9 Mupad [F(-1)]

Timed out.

$$\int \frac{x^2 \sin(c + dx)}{a + bx} dx = \int \frac{x^2 \sin(c + d x)}{a + b x} dx$$

input
```
int((x^2*sin(c + d*x))/(a + b*x),x)
```

output
```
int((x^2*sin(c + d*x))/(a + b*x), x)
```

# 3.21 $\int \frac{x\sin(c+dx)}{a+bx}\,dx$



## 3.21.1 Optimal result

Integrand size = 15, antiderivative size = 69

$$\int \frac{x\sin(c+dx)}{a+bx}\,dx = -\frac{\cos(c+dx)}{bd} - \frac{a\,\mathrm{CosIntegral}\left(\frac{ad}{b}+dx\right)\sin\left(c-\frac{ad}{b}\right)}{b^2} - \frac{a\cos\left(c-\frac{ad}{b}\right)\mathrm{Si}\left(\frac{ad}{b}+dx\right)}{b^2}$$

output
```
-cos(d*x+c)/b/d-a*cos(-c+a*d/b)*Si(a*d/b+d*x)/b^2+a*Ci(a*d/b+d*x)*sin(-c+a
*d/b)/b^2
```

## 3.21.2 Mathematica [A] (verified)

Time = 0.11 (sec) , antiderivative size = 63, normalized size of antiderivative = 0.91

$$\int \frac{x\sin(c+dx)}{a+bx}\,dx = -\frac{b\cos(c+dx)+ad\,\mathrm{CosIntegral}\left(d\left(\frac{a}{b}+x\right)\right)\sin\left(c-\frac{ad}{b}\right)+ad\cos\left(c-\frac{ad}{b}\right)\mathrm{Si}\left(d\left(\frac{a}{b}+x\right)\right)}{b^2d}$$

input
```
Integrate[(x*Sin[c + d*x])/(a + b*x),x]
```

output
```
-((b*Cos[c + d*x] + a*d*CosIntegral[d*(a/b + x)]*Sin[c - (a*d)/b] + a*d*Co
s[c - (a*d)/b]*SinIntegral[d*(a/b + x)])/(b^2*d))
```

### 3.21.3 Rubi [A] (verified)

Time = 0.36 (sec) , antiderivative size = 69, normalized size of antiderivative = 1.00, number of steps used = 2, number of rules used = 2, $\frac{\text{number of rules}}{\text{integrand size}}$ = 0.133, Rules used = {7293, 2009}

Below are the steps used by Rubi to obtain the solution. The rule number used for the transformation is given above next to the arrow. The rules definitions used are listed below.

$$\int \frac{x\sin(c+dx)}{a+bx}\,dx$$

$$\Big\downarrow \text{7293}$$

$$\int \left(\frac{\sin(c+dx)}{b}-\frac{a\sin(c+dx)}{b(a+bx)}\right)dx$$

$$\Big\downarrow \text{2009}$$

$$-\frac{a\sin\left(c-\frac{ad}{b}\right)\text{CosIntegral}\left(xd+\frac{ad}{b}\right)}{b^2}-\frac{a\cos\left(c-\frac{ad}{b}\right)\text{Si}\left(xd+\frac{ad}{b}\right)}{b^2}-\frac{\cos(c+dx)}{bd}$$

input
```
Int[(x*Sin[c + d*x])/(a + b*x),x]
```

output
```
-(Cos[c + d*x]/(b*d)) - (a*CosIntegral[(a*d)/b + d*x]*Sin[c - (a*d)/b])/b^
2 - (a*Cos[c - (a*d)/b]*SinIntegral[(a*d)/b + d*x])/b^2
```

#### 3.21.3.1 Defintions of rubi rules used

rule 2009
```
Int[u_, x_Symbol] :> Simp[IntSum[u, x], x] /; SumQ[u]
```

rule 7293
```
Int[u_, x_Symbol] :> With[{v = ExpandIntegrand[u, x]}, Int[v, x] /; SumQ[v]
]
```

### 3.21.4 Maple [C] (verified)

Result contains complex when optimal does not.

Time = 0.25 (sec) , antiderivative size = 150, normalized size of antiderivative = 2.17

| method | result |
|---|---|
| risch | $-\frac{\cos(dx+c)}{bd}+\frac{ia\cos\left(\frac{da-cb}{b}\right)\mathrm{Ei}_1\left(\frac{id(bx+a)}{b}\right)}{2b^2}-\frac{ia\cos\left(\frac{da-cb}{b}\right)\mathrm{Ei}_1\left(-\frac{id(bx+a)}{b}\right)}{2b^2}-\frac{a\sin\left(\frac{da-cb}{b}\right)\mathrm{Ei}_1\left(\frac{id(bx+a)}{b}\right)}{2b^2}$ |
| derivativedivides | $\frac{-\frac{(da-cb)d\left(\frac{\mathrm{Si}\left(dx+c+\frac{da-cb}{b}\right)\cos\left(\frac{da-cb}{b}\right)}{b}-\frac{\mathrm{Ci}\left(dx+c+\frac{da-cb}{b}\right)\sin\left(\frac{da-cb}{b}\right)}{b}\right)}{b}-\frac{d\cos(dx+c)}{b}-dc\left(\frac{\mathrm{Si}\left(dx+c+\frac{da-cb}{b}\right)\cos\left(\frac{da-c}{b}\right.}{b}\right.}{d^2}$ |
| default | $\frac{-\frac{(da-cb)d\left(\frac{\mathrm{Si}\left(dx+c+\frac{da-cb}{b}\right)\cos\left(\frac{da-cb}{b}\right)}{b}-\frac{\mathrm{Ci}\left(dx+c+\frac{da-cb}{b}\right)\sin\left(\frac{da-cb}{b}\right)}{b}\right)}{b}-\frac{d\cos(dx+c)}{b}-dc\left(\frac{\mathrm{Si}\left(dx+c+\frac{da-cb}{b}\right)\cos\left(\frac{da-c}{b}\right.}{b}\right.}{d^2}$ |

input
```
int(x*sin(d*x+c)/(b*x+a),x,method=_RETURNVERBOSE)
```

output
```
-cos(d*x+c)/b/d+1/2*I*a/b^2*cos((a*d-b*c)/b)*Ei(1,I*d*(b*x+a)/b)-1/2*I*a/b
^2*cos((a*d-b*c)/b)*Ei(1,-I*d*(b*x+a)/b)-1/2*a/b^2*sin((a*d-b*c)/b)*Ei(1,I
*d*(b*x+a)/b)-1/2*a/b^2*sin((a*d-b*c)/b)*Ei(1,-I*d*(b*x+a)/b)
```

### 3.21.5 Fricas [A] (verification not implemented)

Time = 0.27 (sec) , antiderivative size = 78, normalized size of antiderivative = 1.13

$$\int \frac{x\sin(c+dx)}{a+bx}\,dx = \frac{ad\,\mathrm{Ci}\left(\frac{bdx+ad}{b}\right)\sin\left(-\frac{bc-ad}{b}\right)-ad\cos\left(-\frac{bc-ad}{b}\right)\mathrm{Si}\left(\frac{bdx+ad}{b}\right)-b\cos(dx+c)}{b^2d}$$

input
```
integrate(x*sin(d*x+c)/(b*x+a),x, algorithm="fricas")
```

output
```
(a*d*cos_integral((b*d*x + a*d)/b)*sin(-(b*c - a*d)/b) - a*d*cos(-(b*c - a
*d)/b)*sin_integral((b*d*x + a*d)/b) - b*cos(d*x + c))/(b^2*d)
```

### 3.21.6 Sympy [F]

$$\int \frac{x \sin(c+dx)}{a+bx}\,dx = \int \frac{x \sin{(c+dx)}}{a+bx}\,dx$$

input
```
integrate(x*sin(d*x+c)/(b*x+a),x)
```

output
```
Integral(x*sin(c + d*x)/(a + b*x), x)
```

### 3.21.7 Maxima [C] (verification not implemented)

Result contains complex when optimal does not.

Time = 0.28 (sec) , antiderivative size = 776, normalized size of antiderivative = 11.25

$$\int \frac{x \sin(c+dx)}{a+bx}\,dx = -\frac{\frac{\left(d\left(-i\,E_1\left(\frac{i\,(dx+c)b-i\,bc+i\,ad}{b}\right)+i\,E_1\left(-\frac{i\,(dx+c)b-i\,bc+i\,ad}{b}\right)\right)\cos\left(-\frac{bc-ad}{b}\right)+d\left(E_1\left(\frac{i\,(dx+c)b-i\,bc+i\,ad}{b}\right)+E_1\left(-\frac{i\,(dx+c)b-i\,bc+i\,ad}{b}\right)\right)\sin\left(-\frac{b}{}\right.}{b}}{}$$

input
```
integrate(x*sin(d*x+c)/(b*x+a),x, algorithm="maxima")
```

output
```
-1/2*((d*(-I*exp_integral_e(1, (I*(d*x + c)*b - I*b*c + I*a*d)/b) + I*exp_
integral_e(1, -(I*(d*x + c)*b - I*b*c + I*a*d)/b))*cos(-(b*c - a*d)/b) + d
*(exp_integral_e(1, (I*(d*x + c)*b - I*b*c + I*a*d)/b) + exp_integral_e(1,
 -(I*(d*x + c)*b - I*b*c + I*a*d)/b))*sin(-(b*c - a*d)/b))*c/b + ((d*x + c
)*b*d*cos(d*x + c)^3 + (d*x + c)*b*d*cos(d*x + c) - ((b*c*d*(exp_integral_
e(2, (I*(d*x + c)*b - I*b*c + I*a*d)/b) + exp_integral_e(2, -(I*(d*x + c)*
b - I*b*c + I*a*d)/b)) - a*d^2*(exp_integral_e(2, (I*(d*x + c)*b - I*b*c +
 I*a*d)/b) + exp_integral_e(2, -(I*(d*x + c)*b - I*b*c + I*a*d)/b)))*cos(-
(b*c - a*d)/b) - (a*d^2*(I*exp_integral_e(2, (I*(d*x + c)*b - I*b*c + I*a*
d)/b) - I*exp_integral_e(2, -(I*(d*x + c)*b - I*b*c + I*a*d)/b)) + b*c*d*(
-I*exp_integral_e(2, (I*(d*x + c)*b - I*b*c + I*a*d)/b) + I*exp_integral_e
(2, -(I*(d*x + c)*b - I*b*c + I*a*d)/b)))*sin(-(b*c - a*d)/b))*cos(d*x + c
)^2 + ((d*x + c)*b*d*cos(d*x + c) - (b*c*d*(exp_integral_e(2, (I*(d*x + c)
*b - I*b*c + I*a*d)/b) + exp_integral_e(2, -(I*(d*x + c)*b - I*b*c + I*a*d
)/b)) - a*d^2*(exp_integral_e(2, (I*(d*x + c)*b - I*b*c + I*a*d)/b) + exp_
integral_e(2, -(I*(d*x + c)*b - I*b*c + I*a*d)/b)))*cos(-(b*c - a*d)/b) +
(a*d^2*(I*exp_integral_e(2, (I*(d*x + c)*b - I*b*c + I*a*d)/b) - I*exp_int
egral_e(2, -(I*(d*x + c)*b - I*b*c + I*a*d)/b)) + b*c*d*(-I*exp_integral_e
(2, (I*(d*x + c)*b - I*b*c + I*a*d)/b) + I*exp_integral_e(2, -(I*(d*x + c)
*b - I*b*c + I*a*d)/b)))*sin(-(b*c - a*d)/b))*sin(d*x + c)^2)/(((d*x + ...
```

### 3.21.8 Giac [C] (verification not implemented)

Result contains higher order function than in optimal. Order 9 vs. order 4.

Time = 0.32 (sec) , antiderivative size = 1647, normalized size of antiderivative = 23.87

$$\int \frac{x\sin(c+dx)}{a+bx}\,dx = \text{Too large to display}$$

input
```
integrate(x*sin(d*x+c)/(b*x+a),x, algorithm="giac")
```

output
```
-1/2*(a*d*imag_part(cos_integral(d*x + a*d/b))*tan(1/2*d*x)^2*tan(1/2*c)^2
*tan(1/2*a*d/b)^2 - a*d*imag_part(cos_integral(-d*x - a*d/b))*tan(1/2*d*x)
^2*tan(1/2*c)^2*tan(1/2*a*d/b)^2 + 2*a*d*sin_integral((b*d*x + a*d)/b)*tan
(1/2*d*x)^2*tan(1/2*c)^2*tan(1/2*a*d/b)^2 + 2*a*d*real_part(cos_integral(d
*x + a*d/b))*tan(1/2*d*x)^2*tan(1/2*c)^2*tan(1/2*a*d/b) + 2*a*d*real_part(
cos_integral(-d*x - a*d/b))*tan(1/2*d*x)^2*tan(1/2*c)^2*tan(1/2*a*d/b) - 2
*a*d*real_part(cos_integral(d*x + a*d/b))*tan(1/2*d*x)^2*tan(1/2*c)*tan(1/
2*a*d/b)^2 - 2*a*d*real_part(cos_integral(-d*x - a*d/b))*tan(1/2*d*x)^2*ta
n(1/2*c)*tan(1/2*a*d/b)^2 - a*d*imag_part(cos_integral(d*x + a*d/b))*tan(1
/2*d*x)^2*tan(1/2*c)^2 + a*d*imag_part(cos_integral(-d*x - a*d/b))*tan(1/2
*d*x)^2*tan(1/2*c)^2 - 2*a*d*sin_integral((b*d*x + a*d)/b)*tan(1/2*d*x)^2*
tan(1/2*c)^2 + 4*a*d*imag_part(cos_integral(d*x + a*d/b))*tan(1/2*d*x)^2*t
an(1/2*c)*tan(1/2*a*d/b) - 4*a*d*imag_part(cos_integral(-d*x - a*d/b))*tan
(1/2*d*x)^2*tan(1/2*c)*tan(1/2*a*d/b) + 8*a*d*sin_integral((b*d*x + a*d)/b
)*tan(1/2*d*x)^2*tan(1/2*c)*tan(1/2*a*d/b) - a*d*imag_part(cos_integral(d*
x + a*d/b))*tan(1/2*d*x)^2*tan(1/2*a*d/b)^2 + a*d*imag_part(cos_integral(-
d*x - a*d/b))*tan(1/2*d*x)^2*tan(1/2*a*d/b)^2 - 2*a*d*sin_integral((b*d*x
+ a*d)/b)*tan(1/2*d*x)^2*tan(1/2*a*d/b)^2 + a*d*imag_part(cos_integral(d*x
 + a*d/b))*tan(1/2*c)^2*tan(1/2*a*d/b)^2 - a*d*imag_part(cos_integral(-d*x
 - a*d/b))*tan(1/2*c)^2*tan(1/2*a*d/b)^2 + 2*a*d*sin_integral((b*d*x + ...
```

### 3.21.9 Mupad [F(-1)]

Timed out.

$$\int \frac{x\sin(c+dx)}{a+bx}\,dx = \int \frac{x\,\sin\left(c+d\,x\right)}{a+b\,x}\,dx$$

input
```
int((x*sin(c + d*x))/(a + b*x),x)
```

output
```
int((x*sin(c + d*x))/(a + b*x), x)
```

# 3.22 $\int \frac{\sin(c+dx)}{a+bx}\,dx$



## 3.22.1 Optimal result

Integrand size = 14, antiderivative size = 51

$$\int \frac{\sin(c+dx)}{a+bx}\,dx=\frac{\text{CosIntegral}\left(\frac{ad}{b}+dx\right)\sin\left(c-\frac{ad}{b}\right)}{b}+\frac{\cos\left(c-\frac{ad}{b}\right)\text{Si}\left(\frac{ad}{b}+dx\right)}{b}$$

output
```
cos(-c+a*d/b)*Si(a*d/b+d*x)/b-Ci(a*d/b+d*x)*sin(-c+a*d/b)/b
```

## 3.22.2 Mathematica [A] (verified)

Time = 0.07 (sec) , antiderivative size = 49, normalized size of antiderivative = 0.96

$$\int \frac{\sin(c+dx)}{a+bx}\,dx=\frac{\text{CosIntegral}\left(\frac{ad}{b}+dx\right)\sin\left(c-\frac{ad}{b}\right)+\cos\left(c-\frac{ad}{b}\right)\text{Si}\left(\frac{ad}{b}+dx\right)}{b}$$

input
```
Integrate[Sin[c + d*x]/(a + b*x),x]
```

output
```
(CosIntegral[(a*d)/b + d*x]*Sin[c - (a*d)/b] + Cos[c - (a*d)/b]*SinIntegra
l[(a*d)/b + d*x])/b
```

### 3.22.3 Rubi [A] (verified)

Time = 0.36 (sec) , antiderivative size = 51, normalized size of antiderivative = 1.00, number of steps used = 5, number of rules used = 5, $\frac{\text{number of rules}}{\text{integrand size}}$ = 0.357, Rules used = {3042, 3784, 3042, 3780, 3783}

Below are the steps used by Rubi to obtain the solution. The rule number used for the transformation is given above next to the arrow. The rules definitions used are listed below.

$$\int \frac{\sin(c+dx)}{a+bx} \, dx$$

$$\Big\downarrow \text{3042}$$

$$\int \frac{\sin(c+dx)}{a+bx}dx$$

$$\Big\downarrow \text{3784}$$

$$\sin\left(c-\frac{ad}{b}\right)\int \frac{\cos\left(xd+\frac{ad}{b}\right)}{a+bx}dx+\cos\left(c-\frac{ad}{b}\right)\int \frac{\sin\left(xd+\frac{ad}{b}\right)}{a+bx}dx$$

$$\Big\downarrow \text{3042}$$

$$\sin\left(c-\frac{ad}{b}\right)\int \frac{\sin\left(xd+\frac{ad}{b}+\frac{\pi}{2}\right)}{a+bx}dx+\cos\left(c-\frac{ad}{b}\right)\int \frac{\sin\left(xd+\frac{ad}{b}\right)}{a+bx}dx$$

$$\Big\downarrow \text{3780}$$

$$\sin\left(c-\frac{ad}{b}\right)\int \frac{\sin\left(xd+\frac{ad}{b}+\frac{\pi}{2}\right)}{a+bx}dx+\frac{\cos\left(c-\frac{ad}{b}\right)\text{Si}\left(xd+\frac{ad}{b}\right)}{b}$$

$$\Big\downarrow \text{3783}$$

$$\frac{\sin\left(c-\frac{ad}{b}\right)\text{CosIntegral}\left(xd+\frac{ad}{b}\right)}{b}+\frac{\cos\left(c-\frac{ad}{b}\right)\text{Si}\left(xd+\frac{ad}{b}\right)}{b}$$

input
```
Int[Sin[c + d*x]/(a + b*x),x]
```

output
```
(CosIntegral[(a*d)/b + d*x]*Sin[c - (a*d)/b])/b + (Cos[c - (a*d)/b]*SinInt
egral[(a*d)/b + d*x])/b
```

### 3.22.3.1 Defintions of rubi rules used

rule 3042
```
Int[u_, x_Symbol] :> Int[DeactivateTrig[u, x], x] /; FunctionOfTrigOfLinear
Q[u, x]
```

rule 3780
```
Int[sin[(e_.) + (f_.)*(x_)]/((c_.) + (d_.)*(x_)), x_Symbol] :> Simp[SinInte
gral[e + f*x]/d, x] /; FreeQ[{c, d, e, f}, x] && EqQ[d*e - c*f, 0]
```

rule 3783
```
Int[sin[(e_.) + (f_.)*(x_)]/((c_.) + (d_.)*(x_)), x_Symbol] :> Simp[CosInte
gral[e - Pi/2 + f*x]/d, x] /; FreeQ[{c, d, e, f}, x] && EqQ[d*(e - Pi/2) -
c*f, 0]
```

rule 3784
```
Int[sin[(e_.) + (f_.)*(x_)]/((c_.) + (d_.)*(x_)), x_Symbol] :> Simp[Cos[(d*
e - c*f)/d]   Int[Sin[c*(f/d) + f*x]/(c + d*x), x], x] + Simp[Sin[(d*e - c*
f)/d]   Int[Cos[c*(f/d) + f*x]/(c + d*x), x], x] /; FreeQ[{c, d, e, f}, x]
&& NeQ[d*e - c*f, 0]
```

## 3.22.4 Maple [A] (verified)

Time = 0.22 (sec) , antiderivative size = 73, normalized size of antiderivative = 1.43

| method | result | size |
|---|---|---|
| derivativedivides | $\frac{\operatorname{Si}\left(dx+c+\frac{da-cb}{b}\right)\cos\left(\frac{da-cb}{b}\right)}{b}-\frac{\operatorname{Ci}\left(dx+c+\frac{da-cb}{b}\right)\sin\left(\frac{da-cb}{b}\right)}{b}$ | 73 |
| default | $\frac{\operatorname{Si}\left(dx+c+\frac{da-cb}{b}\right)\cos\left(\frac{da-cb}{b}\right)}{b}-\frac{\operatorname{Ci}\left(dx+c+\frac{da-cb}{b}\right)\sin\left(\frac{da-cb}{b}\right)}{b}$ | 73 |
| risch | $\frac{i\mathrm{e}^{-\frac{i(da-cb)}{b}}\operatorname{Ei}_{1}\left(-idx-ic-\frac{iad-icb}{b}\right)}{2b}-\frac{i\mathrm{e}^{\frac{i(da-cb)}{b}}\operatorname{Ei}_{1}\left(idx+ic+\frac{i(da-cb)}{b}\right)}{2b}$ | 98 |

input
```
int(sin(d*x+c)/(b*x+a),x,method=_RETURNVERBOSE)
```

output
```
Si(d*x+c+(a*d-b*c)/b)*cos((a*d-b*c)/b)/b-Ci(d*x+c+(a*d-b*c)/b)*sin((a*d-b*
c)/b)/b
```

### 3.22.5 Fricas [A] (verification not implemented)

Time = 0.27 (sec) , antiderivative size = 63, normalized size of antiderivative = 1.24

$$\int \frac{\sin(c+dx)}{a+bx}\,dx = -\frac{\operatorname{Ci}\left(\frac{bdx+ad}{b}\right)\sin\left(-\frac{bc-ad}{b}\right)-\cos\left(-\frac{bc-ad}{b}\right)\operatorname{Si}\left(\frac{bdx+ad}{b}\right)}{b}$$

input
```
integrate(sin(d*x+c)/(b*x+a),x, algorithm="fricas")
```

output
```
-(cos_integral((b*d*x + a*d)/b)*sin(-(b*c - a*d)/b) - cos(-(b*c - a*d)/b)*
sin_integral((b*d*x + a*d)/b))/b
```

### 3.22.6 Sympy [F]

$$\int \frac{\sin(c+dx)}{a+bx}\,dx = \int \frac{\sin(c+dx)}{a+bx}\,dx$$

input
```
integrate(sin(d*x+c)/(b*x+a),x)
```

output
```
Integral(sin(c + d*x)/(a + b*x), x)
```

### 3.22.7 Maxima [C] (verification not implemented)

Result contains complex when optimal does not.

Time = 0.22 (sec) , antiderivative size = 141, normalized size of antiderivative = 2.76

$$\int \frac{\sin(c+dx)}{a+bx}\,dx$$
$$= \frac{d\left(-i\,E_1\left(\frac{i\,(dx+c)b-i\,bc+i\,ad}{b}\right)+i\,E_1\left(-\frac{i\,(dx+c)b-i\,bc+i\,ad}{b}\right)\right)\cos\left(-\frac{bc-ad}{b}\right)+d\left(E_1\left(\frac{i\,(dx+c)b-i\,bc+i\,ad}{b}\right)+E_1\left(-\frac{i\,(d\cdots}{}\right)\right)}{2\,bd}$$

input
```
integrate(sin(d*x+c)/(b*x+a),x, algorithm="maxima")
```

output
```
1/2*(d*(-I*exp_integral_e(1, (I*(d*x + c)*b - I*b*c + I*a*d)/b) + I*exp_in
tegral_e(1, -(I*(d*x + c)*b - I*b*c + I*a*d)/b))*cos(-(b*c - a*d)/b) + d*(
exp_integral_e(1, (I*(d*x + c)*b - I*b*c + I*a*d)/b) + exp_integral_e(1, -
(I*(d*x + c)*b - I*b*c + I*a*d)/b))*sin(-(b*c - a*d)/b))/(b*d)
```

### 3.22.8 Giac [C] (verification not implemented)

Result contains higher order function than in optimal. Order 9 vs. order 4.

Time = 0.33 (sec) , antiderivative size = 597, normalized size of antiderivative = 11.71

$$\int \frac{\sin(c+dx)}{a+bx}\,dx$$
$$= \frac{\Im\left(\operatorname{Ci}\left(dx+\frac{ad}{b}\right)\right)\tan\left(\frac{1}{2}c\right)^2\tan\left(\frac{ad}{2b}\right)^2-\Im\left(\operatorname{Ci}\left(-dx-\frac{ad}{b}\right)\right)\tan\left(\frac{1}{2}c\right)^2\tan\left(\frac{ad}{2b}\right)^2+2\operatorname{Si}\left(\frac{bdx+ad}{b}\right)\tan\left(\frac{1}{2}c\right)^2 \mathrm{t}}{}$$

input
```
integrate(sin(d*x+c)/(b*x+a),x, algorithm="giac")
```

output
```
1/2*(imag_part(cos_integral(d*x + a*d/b))*tan(1/2*c)^2*tan(1/2*a*d/b)^2 -
imag_part(cos_integral(-d*x - a*d/b))*tan(1/2*c)^2*tan(1/2*a*d/b)^2 + 2*si
n_integral((b*d*x + a*d)/b)*tan(1/2*c)^2*tan(1/2*a*d/b)^2 + 2*real_part(co
s_integral(d*x + a*d/b))*tan(1/2*c)^2*tan(1/2*a*d/b) + 2*real_part(cos_int
egral(-d*x - a*d/b))*tan(1/2*c)^2*tan(1/2*a*d/b) - 2*real_part(cos_integra
l(d*x + a*d/b))*tan(1/2*c)*tan(1/2*a*d/b)^2 - 2*real_part(cos_integral(-d*
x - a*d/b))*tan(1/2*c)*tan(1/2*a*d/b)^2 - imag_part(cos_integral(d*x + a*d
/b))*tan(1/2*c)^2 + imag_part(cos_integral(-d*x - a*d/b))*tan(1/2*c)^2 - 2
*sin_integral((b*d*x + a*d)/b)*tan(1/2*c)^2 + 4*imag_part(cos_integral(d*x
 + a*d/b))*tan(1/2*c)*tan(1/2*a*d/b) - 4*imag_part(cos_integral(-d*x - a*d
/b))*tan(1/2*c)*tan(1/2*a*d/b) + 8*sin_integral((b*d*x + a*d)/b)*tan(1/2*c
)*tan(1/2*a*d/b) - imag_part(cos_integral(d*x + a*d/b))*tan(1/2*a*d/b)^2 +
 imag_part(cos_integral(-d*x - a*d/b))*tan(1/2*a*d/b)^2 - 2*sin_integral((
b*d*x + a*d)/b)*tan(1/2*a*d/b)^2 + 2*real_part(cos_integral(d*x + a*d/b))*
tan(1/2*c) + 2*real_part(cos_integral(-d*x - a*d/b))*tan(1/2*c) - 2*real_p
art(cos_integral(d*x + a*d/b))*tan(1/2*a*d/b) - 2*real_part(cos_integral(-
d*x - a*d/b))*tan(1/2*a*d/b) + imag_part(cos_integral(d*x + a*d/b)) - imag
_part(cos_integral(-d*x - a*d/b)) + 2*sin_integral((b*d*x + a*d)/b))/(b*ta
n(1/2*c)^2*tan(1/2*a*d/b)^2 + b*tan(1/2*c)^2 + b*tan(1/2*a*d/b)^2 + b)
```

### 3.22.9 Mupad [F(-1)]

Timed out.

$$\int \frac{\sin(c+dx)}{a+bx}\,dx = \int \frac{\sin\left(c+d\,x\right)}{a+b\,x}\,dx$$

input
```
int(sin(c + d*x)/(a + b*x),x)
```

output
```
int(sin(c + d*x)/(a + b*x), x)
```

# 3.23 $\int \frac{\sin(c+dx)}{x(a+bx)}\,dx$



## 3.23.1 Optimal result

Integrand size = 17, antiderivative size = 73

$$\int \frac{\sin(c+dx)}{x(a+bx)}\,dx = \frac{\text{CosIntegral}(dx)\sin(c)}{a} - \frac{\text{CosIntegral}\left(\frac{ad}{b}+dx\right)\sin\left(c-\frac{ad}{b}\right)}{a} + \frac{\cos(c)\text{Si}(dx)}{a} - \frac{\cos\left(c-\frac{ad}{b}\right)\text{Si}\left(\frac{ad}{b}+dx\right)}{a}$$

output
```
cos(c)*Si(d*x)/a-cos(-c+a*d/b)*Si(a*d/b+d*x)/a+Ci(d*x)*sin(c)/a+Ci(a*d/b+d
*x)*sin(-c+a*d/b)/a
```

## 3.23.2 Mathematica [A] (verified)

Time = 0.10 (sec) , antiderivative size = 63, normalized size of antiderivative = 0.86

$$\int \frac{\sin(c+dx)}{x(a+bx)}\,dx = \frac{\text{CosIntegral}(dx)\sin(c) - \text{CosIntegral}\left(d\left(\frac{a}{b}+x\right)\right)\sin\left(c-\frac{ad}{b}\right) + \cos(c)\text{Si}(dx) - \cos\left(c-\frac{ad}{b}\right)\text{Si}\left(d\left(\frac{a}{b}+x\right)\right)}{a}$$

input
```
Integrate[Sin[c + d*x]/(x*(a + b*x)),x]
```

output
```
(CosIntegral[d*x]*Sin[c] - CosIntegral[d*(a/b + x)]*Sin[c - (a*d)/b] + Cos
[c]*SinIntegral[d*x] - Cos[c - (a*d)/b]*SinIntegral[d*(a/b + x)])/a
```

### 3.23.3 Rubi [A] (verified)

Time = 0.42 (sec) , antiderivative size = 73, normalized size of antiderivative = 1.00, number of steps used = 2, number of rules used = 2, $\frac{\text{number of rules}}{\text{integrand size}}$ = 0.118, Rules used = {7293, 2009}

Below are the steps used by Rubi to obtain the solution. The rule number used for the transformation is given above next to the arrow. The rules definitions used are listed below.

$$\int \frac{\sin(c+dx)}{x(a+bx)} \, dx$$

$$\Big\downarrow \; 7293$$

$$\int \left(\frac{\sin(c+dx)}{ax} - \frac{b\sin(c+dx)}{a(a+bx)}\right) dx$$

$$\Big\downarrow \; 2009$$

$$-\frac{\sin\left(c-\frac{ad}{b}\right) \text{CosIntegral}\left(xd+\frac{ad}{b}\right)}{a} - \frac{\cos\left(c-\frac{ad}{b}\right) \text{Si}\left(xd+\frac{ad}{b}\right)}{a} + \frac{\sin(c) \text{CosIntegral}(dx)}{a} + \frac{\cos(c)\text{Si}(dx)}{a}$$

input
```
Int[Sin[c + d*x]/(x*(a + b*x)),x]
```

output
```
(CosIntegral[d*x]*Sin[c])/a - (CosIntegral[(a*d)/b + d*x]*Sin[c - (a*d)/b]
)/a + (Cos[c]*SinIntegral[d*x])/a - (Cos[c - (a*d)/b]*SinIntegral[(a*d)/b
+ d*x])/a
```

#### 3.23.3.1 Defintions of rubi rules used

rule 2009
```
Int[u_, x_Symbol] :> Simp[IntSum[u, x], x] /; SumQ[u]
```

rule 7293
```
Int[u_, x_Symbol] :> With[{v = ExpandIntegrand[u, x]}, Int[v, x] /; SumQ[v]
]
```

### 3.23.4 Maple [A] (verified)

Time = 0.24 (sec) , antiderivative size = 99, normalized size of antiderivative = 1.36

| method | result |
|---|---|
| derivativedivides | $\frac{\operatorname{Si}(dx)\cos(c)+\operatorname{Ci}(dx)\sin(c)}{a}-\frac{b\left(\frac{\operatorname{Si}\left(dx+c+\frac{da-cb}{b}\right)\cos\left(\frac{da-cb}{b}\right)}{b}-\frac{\operatorname{Ci}\left(dx+c+\frac{da-cb}{b}\right)\sin\left(\frac{da-cb}{b}\right)}{b}\right)}{a}$ |
| default | $\frac{\operatorname{Si}(dx)\cos(c)+\operatorname{Ci}(dx)\sin(c)}{a}-\frac{b\left(\frac{\operatorname{Si}\left(dx+c+\frac{da-cb}{b}\right)\cos\left(\frac{da-cb}{b}\right)}{b}-\frac{\operatorname{Ci}\left(dx+c+\frac{da-cb}{b}\right)\sin\left(\frac{da-cb}{b}\right)}{b}\right)}{a}$ |
| risch | $\frac{i\mathrm{e}^{ic}\operatorname{Ei}_1(-idx)}{2a}-\frac{i\mathrm{e}^{-\frac{i(da-cb)}{b}}\operatorname{Ei}_1\left(-idx-ic-\frac{iad-icb}{b}\right)}{2a}-\frac{\mathrm{e}^{-ic}\pi\operatorname{csgn}(dx)}{2a}+\frac{\mathrm{e}^{-ic}\operatorname{Si}(dx)}{a}-\frac{i\mathrm{e}^{-ic}\operatorname{Ei}_1(-idx)}{2a}+$ |

input
```
int(sin(d*x+c)/x/(b*x+a),x,method=_RETURNVERBOSE)
```

output
```
1/a*(Si(d*x)*cos(c)+Ci(d*x)*sin(c))-b/a*(Si(d*x+c+(a*d-b*c)/b)*cos((a*d-b*
c)/b)/b-Ci(d*x+c+(a*d-b*c)/b)*sin((a*d-b*c)/b)/b)
```

### 3.23.5 Fricas [A] (verification not implemented)

Time = 0.32 (sec) , antiderivative size = 76, normalized size of antiderivative = 1.04

$$\int \frac{\sin(c+dx)}{x(a+bx)}\,dx = \frac{\operatorname{Ci}(dx)\sin(c)+\operatorname{Ci}\left(\frac{bdx+ad}{b}\right)\sin\left(-\frac{bc-ad}{b}\right)+\cos(c)\operatorname{Si}(dx)-\cos\left(-\frac{bc-ad}{b}\right)\operatorname{Si}\left(\frac{bdx+ad}{b}\right)}{a}$$

input
```
integrate(sin(d*x+c)/x/(b*x+a),x, algorithm="fricas")
```

output
```
(cos_integral(d*x)*sin(c) + cos_integral((b*d*x + a*d)/b)*sin(-(b*c - a*d)
/b) + cos(c)*sin_integral(d*x) - cos(-(b*c - a*d)/b)*sin_integral((b*d*x +
 a*d)/b))/a
```

### 3.23.6 Sympy [F]

$$\int \frac{\sin(c+dx)}{x(a+bx)}\,dx = \int \frac{\sin(c+dx)}{x(a+bx)}\,dx$$

input
```
integrate(sin(d*x+c)/x/(b*x+a),x)
```

output
```
Integral(sin(c + d*x)/(x*(a + b*x)), x)
```

### 3.23.7 Maxima [F]

$$\int \frac{\sin(c+dx)}{x(a+bx)}\,dx = \int \frac{\sin(dx+c)}{(bx+a)x}\,dx$$

input
```
integrate(sin(d*x+c)/x/(b*x+a),x, algorithm="maxima")
```

output
```
integrate(sin(d*x + c)/((b*x + a)*x), x)
```

### 3.23.8 Giac [C] (verification not implemented)

Result contains higher order function than in optimal. Order 9 vs. order 4.

Time = 0.31 (sec) , antiderivative size = 838, normalized size of antiderivative = 11.48

$$\int \frac{\sin(c+dx)}{x(a+bx)}\,dx = \text{Too large to display}$$

input
```
integrate(sin(d*x+c)/x/(b*x+a),x, algorithm="giac")
```

output
```
-1/2*(imag_part(cos_integral(d*x + a*d/b))*tan(1/2*c)^2*tan(1/2*a*d/b)^2 +
 imag_part(cos_integral(d*x))*tan(1/2*c)^2*tan(1/2*a*d/b)^2 - imag_part(co
s_integral(-d*x - a*d/b))*tan(1/2*c)^2*tan(1/2*a*d/b)^2 - imag_part(cos_in
tegral(-d*x))*tan(1/2*c)^2*tan(1/2*a*d/b)^2 + 2*sin_integral(d*x)*tan(1/2*
c)^2*tan(1/2*a*d/b)^2 + 2*sin_integral((b*d*x + a*d)/b)*tan(1/2*c)^2*tan(1
/2*a*d/b)^2 + 2*real_part(cos_integral(d*x + a*d/b))*tan(1/2*c)^2*tan(1/2*
a*d/b) + 2*real_part(cos_integral(-d*x - a*d/b))*tan(1/2*c)^2*tan(1/2*a*d/
b) - 2*real_part(cos_integral(d*x + a*d/b))*tan(1/2*c)*tan(1/2*a*d/b)^2 -
2*real_part(cos_integral(d*x))*tan(1/2*c)*tan(1/2*a*d/b)^2 - 2*real_part(c
os_integral(-d*x - a*d/b))*tan(1/2*c)*tan(1/2*a*d/b)^2 - 2*real_part(cos_i
ntegral(-d*x))*tan(1/2*c)*tan(1/2*a*d/b)^2 - imag_part(cos_integral(d*x +
a*d/b))*tan(1/2*c)^2 + imag_part(cos_integral(d*x))*tan(1/2*c)^2 + imag_pa
rt(cos_integral(-d*x - a*d/b))*tan(1/2*c)^2 - imag_part(cos_integral(-d*x)
)*tan(1/2*c)^2 + 2*sin_integral(d*x)*tan(1/2*c)^2 - 2*sin_integral((b*d*x
+ a*d)/b)*tan(1/2*c)^2 + 4*imag_part(cos_integral(d*x + a*d/b))*tan(1/2*c)
*tan(1/2*a*d/b) - 4*imag_part(cos_integral(-d*x - a*d/b))*tan(1/2*c)*tan(1
/2*a*d/b) + 8*sin_integral((b*d*x + a*d)/b)*tan(1/2*c)*tan(1/2*a*d/b) - im
ag_part(cos_integral(d*x + a*d/b))*tan(1/2*a*d/b)^2 - imag_part(cos_integr
al(d*x))*tan(1/2*a*d/b)^2 + imag_part(cos_integral(-d*x - a*d/b))*tan(1/2*
a*d/b)^2 + imag_part(cos_integral(-d*x))*tan(1/2*a*d/b)^2 - 2*sin_integ...
```

### 3.23.9 Mupad [F(-1)]

Timed out.

$$\int \frac{\sin(c+dx)}{x(a+bx)}\,dx = \int \frac{\sin\left(c+d\,x\right)}{x\,\left(a+b\,x\right)}\,dx$$

input
```
int(sin(c + d*x)/(x*(a + b*x)),x)
```

output
```
int(sin(c + d*x)/(x*(a + b*x)), x)
```

# 3.24 $\int \frac{\sin(c+dx)}{x^2(a+bx)}\,dx$



## 3.24.1 Optimal result

Integrand size = 17, antiderivative size = 114

$$\int \frac{\sin(c+dx)}{x^2(a+bx)}\,dx = \frac{d\cos(c)\,\text{CosIntegral}(dx)}{a} - \frac{b\,\text{CosIntegral}(dx)\sin(c)}{a^2} + \frac{b\,\text{CosIntegral}\left(\frac{ad}{b}+dx\right)\sin\left(c-\frac{ad}{b}\right)}{a^2} - \frac{\sin(c+dx)}{ax} - \frac{b\cos(c)\text{Si}(dx)}{a^2} - \frac{d\sin(c)\text{Si}(dx)}{a} + \frac{b\cos\left(c-\frac{ad}{b}\right)\text{Si}\left(\frac{ad}{b}+dx\right)}{a^2}$$

output
```
d*Ci(d*x)*cos(c)/a-b*cos(c)*Si(d*x)/a^2+b*cos(-c+a*d/b)*Si(a*d/b+d*x)/a^2-
b*Ci(d*x)*sin(c)/a^2-d*Si(d*x)*sin(c)/a-b*Ci(a*d/b+d*x)*sin(-c+a*d/b)/a^2-
sin(d*x+c)/a/x
```

## 3.24.2 Mathematica [A] (verified)

Time = 0.27 (sec) , antiderivative size = 101, normalized size of antiderivative = 0.89

$$\int \frac{\sin(c+dx)}{x^2(a+bx)}\,dx = \frac{x\,\text{CosIntegral}(dx)(ad\cos(c)-b\sin(c)) + bx\,\text{CosIntegral}\left(d\left(\frac{a}{b}+x\right)\right)\sin\left(c-\frac{ad}{b}\right) - a\sin(c+dx) - bx\cos}{a^2x}$$

input
```
Integrate[Sin[c + d*x]/(x^2*(a + b*x)),x]
```

output
```
(x*CosIntegral[d*x]*(a*d*Cos[c] - b*Sin[c]) + b*x*CosIntegral[d*(a/b + x)]
*Sin[c - (a*d)/b] - a*Sin[c + d*x] - b*x*Cos[c]*SinIntegral[d*x] - a*d*x*S
in[c]*SinIntegral[d*x] + b*x*Cos[c - (a*d)/b]*SinIntegral[d*(a/b + x)])/(a
^2*x)
```

### 3.24.3 Rubi [A] (verified)

Time = 0.53 (sec) , antiderivative size = 114, normalized size of antiderivative = 1.00, number of steps used = 2, number of rules used = 2, $\frac{\text{number of rules}}{\text{integrand size}}$ = 0.118, Rules used = {7293, 2009}

Below are the steps used by Rubi to obtain the solution. The rule number used for the transformation is given above next to the arrow. The rules definitions used are listed below.

$$\int \frac{\sin(c+dx)}{x^2(a+bx)}\,dx$$

$$\Big\downarrow \; 7293$$

$$\int \left(\frac{b^2\sin(c+dx)}{a^2(a+bx)}-\frac{b\sin(c+dx)}{a^2x}+\frac{\sin(c+dx)}{ax^2}\right)dx$$

$$\Big\downarrow \; 2009$$

$$-\frac{b\sin(c)\,\text{CosIntegral}(dx)}{a^2}+\frac{b\sin\left(c-\frac{ad}{b}\right)\text{CosIntegral}\left(xd+\frac{ad}{b}\right)}{a^2}-\frac{b\cos(c)\text{Si}(dx)}{a^2}+\frac{b\cos\left(c-\frac{ad}{b}\right)\text{Si}\left(xd+\frac{ad}{b}\right)}{a^2}+\frac{d\cos(c)\,\text{CosIntegral}(dx)}{a}-\frac{d\sin(c)\text{Si}(dx)}{a}-\frac{\sin(c+dx)}{ax}$$

input
```
Int[Sin[c + d*x]/(x^2*(a + b*x)),x]
```

output
```
(d*Cos[c]*CosIntegral[d*x])/a - (b*CosIntegral[d*x]*Sin[c])/a^2 + (b*CosIn
tegral[(a*d)/b + d*x]*Sin[c - (a*d)/b])/a^2 - Sin[c + d*x]/(a*x) - (b*Cos[
c]*SinIntegral[d*x])/a^2 - (d*Sin[c]*SinIntegral[d*x])/a + (b*Cos[c - (a*d
)/b]*SinIntegral[(a*d)/b + d*x])/a^2
```

#### 3.24.3.1 Defintions of rubi rules used

rule 2009
```
Int[u_, x_Symbol] :> Simp[IntSum[u, x], x] /; SumQ[u]
```

rule 7293
```
Int[u_, x_Symbol] :> With[{v = ExpandIntegrand[u, x]}, Int[v, x] /; SumQ[v]
]
```

### 3.24.4 Maple [A] (verified)

Time = 0.30 (sec) , antiderivative size = 144, normalized size of antiderivative = 1.26

| method | result |
|---|---|
| derivativedivides | $d\Bigg(-\frac{b(\mathrm{Si}(dx)\cos(c)+\mathrm{Ci}(dx)\sin(c))}{a^2d}+\frac{-\frac{\sin(dx+c)}{dx}-\mathrm{Si}(dx)\sin(c)+\mathrm{Ci}(dx)\cos(c)}{a}+\frac{b^2\Big(\frac{\mathrm{Si}\left(dx+c+\frac{da-cb}{b}\right)\cos\left(\frac{da-cb}{b}\right.}{b}}{a}$ |
| default | $d\Bigg(-\frac{b(\mathrm{Si}(dx)\cos(c)+\mathrm{Ci}(dx)\sin(c))}{a^2d}+\frac{-\frac{\sin(dx+c)}{dx}-\mathrm{Si}(dx)\sin(c)+\mathrm{Ci}(dx)\cos(c)}{a}+\frac{b^2\Big(\frac{\mathrm{Si}\left(dx+c+\frac{da-cb}{b}\right)\cos\left(\frac{da-cb}{b}\right.}{b}}{a}$ |
| risch | $\frac{ib\,\mathrm{e}^{-\frac{i(da-cb)}{b}}\,\mathrm{Ei}_1\left(-idx-ic-\frac{iad-icb}{b}\right)}{2a^2}-\frac{ib\,\mathrm{e}^{ic}\,\mathrm{Ei}_1(-idx)}{2a^2}-\frac{\mathrm{e}^{ic}\,\mathrm{Ei}_1(-idx)d}{2a}-\frac{d\,\mathrm{e}^{-ic}\,\mathrm{Ei}_1(idx)}{2a}+\frac{i\mathrm{e}^{-ic}\,\mathrm{Ei}_1(idx)b}{2a^2}$ |

input
```
int(sin(d*x+c)/x^2/(b*x+a),x,method=_RETURNVERBOSE)
```

output
```
d*(-b/a^2/d*(Si(d*x)*cos(c)+Ci(d*x)*sin(c))+1/a*(-sin(d*x+c)/d/x-Si(d*x)*s
in(c)+Ci(d*x)*cos(c))+b^2/a^2/d*(Si(d*x+c+(a*d-b*c)/b)*cos((a*d-b*c)/b)/b-
Ci(d*x+c+(a*d-b*c)/b)*sin((a*d-b*c)/b)/b))
```

### 3.24.5 Fricas [A] (verification not implemented)

Time = 0.27 (sec) , antiderivative size = 118, normalized size of antiderivative = 1.04

$$\int \frac{\sin(c+dx)}{x^2(a+bx)}\,dx =$$
$$-\frac{bx\,\mathrm{Ci}\left(\frac{bdx+ad}{b}\right)\sin\left(-\frac{bc-ad}{b}\right)-bx\cos\left(-\frac{bc-ad}{b}\right)\mathrm{Si}\left(\frac{bdx+ad}{b}\right)-\left(adx\,\mathrm{Ci}\left(dx\right)-bx\,\mathrm{Si}\left(dx\right)\right)\cos\left(c\right)+a\sin\left(dx\right.}{a^2x}$$

input
```
integrate(sin(d*x+c)/x^2/(b*x+a),x, algorithm="fricas")
```

output
```
-(b*x*cos_integral((b*d*x + a*d)/b)*sin(-(b*c - a*d)/b) - b*x*cos(-(b*c -
a*d)/b)*sin_integral((b*d*x + a*d)/b) - (a*d*x*cos_integral(d*x) - b*x*sin
_integral(d*x))*cos(c) + a*sin(d*x + c) + (a*d*x*sin_integral(d*x) + b*x*c
os_integral(d*x))*sin(c))/(a^2*x)
```

### 3.24.6 Sympy [F]

$$\int \frac{\sin(c+dx)}{x^2(a+bx)}\,dx = \int \frac{\sin{(c+dx)}}{x^2\,(a+bx)}\,dx$$

input
```
integrate(sin(d*x+c)/x**2/(b*x+a),x)
```

output
```
Integral(sin(c + d*x)/(x**2*(a + b*x)), x)
```

### 3.24.7 Maxima [F]

$$\int \frac{\sin(c+dx)}{x^2(a+bx)}\,dx = \int \frac{\sin{(dx+c)}}{(bx+a)x^2}\,dx$$

input
```
integrate(sin(d*x+c)/x^2/(b*x+a),x, algorithm="maxima")
```

output
```
integrate(sin(d*x + c)/((b*x + a)*x^2), x)
```

### 3.24.8 Giac [C] (verification not implemented)

Result contains higher order function than in optimal. Order 9 vs. order 4.

Time = 0.36 (sec) , antiderivative size = 2897, normalized size of antiderivative = 25.41

$$\int \frac{\sin(c+dx)}{x^2(a+bx)}\,dx = \text{Too large to display}$$

input
```
integrate(sin(d*x+c)/x^2/(b*x+a),x, algorithm="giac")
```

output
```
-1/2*(a*d*x*real_part(cos_integral(d*x))*tan(1/2*d*x)^2*tan(1/2*c)^2*tan(1
/2*a*d/b)^2 + a*d*x*real_part(cos_integral(-d*x))*tan(1/2*d*x)^2*tan(1/2*c
)^2*tan(1/2*a*d/b)^2 + 2*a*d*x*imag_part(cos_integral(d*x))*tan(1/2*d*x)^2
*tan(1/2*c)*tan(1/2*a*d/b)^2 - 2*a*d*x*imag_part(cos_integral(-d*x))*tan(1
/2*d*x)^2*tan(1/2*c)*tan(1/2*a*d/b)^2 + 4*a*d*x*sin_integral(d*x)*tan(1/2*
d*x)^2*tan(1/2*c)*tan(1/2*a*d/b)^2 - b*x*imag_part(cos_integral(d*x + a*d/
b))*tan(1/2*d*x)^2*tan(1/2*c)^2*tan(1/2*a*d/b)^2 - b*x*imag_part(cos_integ
ral(d*x))*tan(1/2*d*x)^2*tan(1/2*c)^2*tan(1/2*a*d/b)^2 + b*x*imag_part(cos
_integral(-d*x - a*d/b))*tan(1/2*d*x)^2*tan(1/2*c)^2*tan(1/2*a*d/b)^2 + b*
x*imag_part(cos_integral(-d*x))*tan(1/2*d*x)^2*tan(1/2*c)^2*tan(1/2*a*d/b)
^2 - 2*b*x*sin_integral(d*x)*tan(1/2*d*x)^2*tan(1/2*c)^2*tan(1/2*a*d/b)^2
- 2*b*x*sin_integral((b*d*x + a*d)/b)*tan(1/2*d*x)^2*tan(1/2*c)^2*tan(1/2*
a*d/b)^2 + a*d*x*real_part(cos_integral(d*x))*tan(1/2*d*x)^2*tan(1/2*c)^2
+ a*d*x*real_part(cos_integral(-d*x))*tan(1/2*d*x)^2*tan(1/2*c)^2 - 2*b*x*
real_part(cos_integral(d*x + a*d/b))*tan(1/2*d*x)^2*tan(1/2*c)^2*tan(1/2*a
*d/b) - 2*b*x*real_part(cos_integral(-d*x - a*d/b))*tan(1/2*d*x)^2*tan(1/2
*c)^2*tan(1/2*a*d/b) - a*d*x*real_part(cos_integral(d*x))*tan(1/2*d*x)^2*t
an(1/2*a*d/b)^2 - a*d*x*real_part(cos_integral(-d*x))*tan(1/2*d*x)^2*tan(1
/2*a*d/b)^2 + 2*b*x*real_part(cos_integral(d*x + a*d/b))*tan(1/2*d*x)^2*ta
n(1/2*c)*tan(1/2*a*d/b)^2 + 2*b*x*real_part(cos_integral(d*x))*tan(1/2*...
```

### 3.24.9 Mupad [F(-1)]

Timed out.

$$\int \frac{\sin(c+dx)}{x^2(a+bx)}\,dx = \int \frac{\sin\left(c+d\,x\right)}{x^2\,\left(a+b\,x\right)}\,dx$$

input
```
int(sin(c + d*x)/(x^2*(a + b*x)),x)
```

output
```
int(sin(c + d*x)/(x^2*(a + b*x)), x)
```

# 3.25 $\int \frac{\sin(c+dx)}{x^3(a+bx)}\,dx$



## 3.25.1 Optimal result

Integrand size = 17, antiderivative size = 189

$$\begin{aligned}\int \frac{\sin(c+dx)}{x^3(a+bx)}\,dx = &-\frac{d\cos(c+dx)}{2ax}-\frac{bd\cos(c)\operatorname{CosIntegral}(dx)}{a^2}+\frac{b^2\operatorname{CosIntegral}(dx)\sin(c)}{a^3}\\ &-\frac{d^2\operatorname{CosIntegral}(dx)\sin(c)}{2a}-\frac{b^2\operatorname{CosIntegral}\left(\frac{ad}{b}+dx\right)\sin\left(c-\frac{ad}{b}\right)}{a^3}\\ &-\frac{\sin(c+dx)}{2ax^2}+\frac{b\sin(c+dx)}{a^2x}+\frac{b^2\cos(c)\operatorname{Si}(dx)}{a^3}\\ &-\frac{d^2\cos(c)\operatorname{Si}(dx)}{2a}+\frac{bd\sin(c)\operatorname{Si}(dx)}{a^2}-\frac{b^2\cos\left(c-\frac{ad}{b}\right)\operatorname{Si}\left(\frac{ad}{b}+dx\right)}{a^3}\end{aligned}$$

output
```
-b*d*Ci(d*x)*cos(c)/a^2-1/2*d*cos(d*x+c)/a/x+b^2*cos(c)*Si(d*x)/a^3-1/2*d^
2*cos(c)*Si(d*x)/a-b^2*cos(-c+a*d/b)*Si(a*d/b+d*x)/a^3+b^2*Ci(d*x)*sin(c)/
a^3-1/2*d^2*Ci(d*x)*sin(c)/a+b*d*Si(d*x)*sin(c)/a^2+b^2*Ci(a*d/b+d*x)*sin(
-c+a*d/b)/a^3-1/2*sin(d*x+c)/a/x^2+b*sin(d*x+c)/a^2/x
```

## 3.25.2 Mathematica [A] (verified)

Time = 0.43 (sec) , antiderivative size = 176, normalized size of antiderivative = 0.93

$$\int \frac{\sin(c+dx)}{x^3(a+bx)}\,dx = -\frac{a^2dx\cos(c+dx)+x^2\operatorname{CosIntegral}(dx)\left(2abd\cos(c)+\left(-2b^2+a^2d^2\right)\sin(c)\right)+2b^2x^2\operatorname{CosIntegral}\left(d\left(\frac{a}{b}+\right.\right.}{}$$

input
```
Integrate[Sin[c + d*x]/(x^3*(a + b*x)),x]
```

output
```
-1/2*(a^2*d*x*Cos[c + d*x] + x^2*CosIntegral[d*x]*(2*a*b*d*Cos[c] + (-2*b^
2 + a^2*d^2)*Sin[c]) + 2*b^2*x^2*CosIntegral[d*(a/b + x)]*Sin[c - (a*d)/b]
 + a^2*Sin[c + d*x] - 2*a*b*x*Sin[c + d*x] - 2*b^2*x^2*Cos[c]*SinIntegral[
d*x] + a^2*d^2*x^2*Cos[c]*SinIntegral[d*x] - 2*a*b*d*x^2*Sin[c]*SinIntegra
l[d*x] + 2*b^2*x^2*Cos[c - (a*d)/b]*SinIntegral[d*(a/b + x)])/(a^3*x^2)
```

### 3.25.3 Rubi [A] (verified)

Time = 0.67 (sec) , antiderivative size = 189, normalized size of antiderivative = 1.00, number of steps used = 2, number of rules used = 2, $\frac{\text{number of rules}}{\text{integrand size}} = 0.118$, Rules used = {7293, 2009}

Below are the steps used by Rubi to obtain the solution. The rule number used for the transformation is given above next to the arrow. The rules definitions used are listed below.

$$\int \frac{\sin(c+dx)}{x^3(a+bx)} \, dx$$

$$\Big\downarrow \ 7293$$

$$\int \left(-\frac{b^3\sin(c+dx)}{a^3(a+bx)}+\frac{b^2\sin(c+dx)}{a^3x}-\frac{b\sin(c+dx)}{a^2x^2}+\frac{\sin(c+dx)}{ax^3}\right)dx$$

$$\Big\downarrow \ 2009$$

$$\frac{b^2\sin(c)\,\text{CosIntegral}(dx)}{a^3}-\frac{b^2\sin\left(c-\frac{ad}{b}\right)\text{CosIntegral}\left(xd+\frac{ad}{b}\right)}{a^3}+\frac{b^2\cos(c)\text{Si}(dx)}{a^3}-\frac{b^2\cos\left(c-\frac{ad}{b}\right)\text{Si}\left(xd+\frac{ad}{b}\right)}{a^3}-\frac{bd\cos(c)\,\text{CosIntegral}(dx)}{a^2}+\frac{bd\sin(c)\text{Si}(dx)}{a^2}+\frac{b\sin(c+dx)}{a^2x}-\frac{d^2\sin(c)\,\text{CosIntegral}(dx)}{2a}-\frac{d^2\cos(c)\text{Si}(dx)}{2a}-\frac{\sin(c+dx)}{2ax^2}-\frac{d\cos(c+dx)}{2ax}$$

input
```
Int[Sin[c + d*x]/(x^3*(a + b*x)),x]
```

output
```
-1/2*(d*Cos[c + d*x])/(a*x) - (b*d*Cos[c]*CosIntegral[d*x])/a^2 + (b^2*Cos
Integral[d*x]*Sin[c])/a^3 - (d^2*CosIntegral[d*x]*Sin[c])/(2*a) - (b^2*Cos
Integral[(a*d)/b + d*x]*Sin[c - (a*d)/b])/a^3 - Sin[c + d*x]/(2*a*x^2) + (
b*Sin[c + d*x])/(a^2*x) + (b^2*Cos[c]*SinIntegral[d*x])/a^3 - (d^2*Cos[c]*
SinIntegral[d*x])/(2*a) + (b*d*Sin[c]*SinIntegral[d*x])/a^2 - (b^2*Cos[c -
 (a*d)/b]*SinIntegral[(a*d)/b + d*x])/a^3
```

#### 3.25.3.1 Defintions of rubi rules used

rule 2009
```
Int[u_, x_Symbol] :> Simp[IntSum[u, x], x] /; SumQ[u]
```

rule 7293
```
Int[u_, x_Symbol] :> With[{v = ExpandIntegrand[u, x]}, Int[v, x] /; SumQ[v]
]
```

### 3.25.4 Maple [A] (verified)

Time = 0.36 (sec) , antiderivative size = 202, normalized size of antiderivative = 1.07

| method | result |
|---|---|
| derivativedivides | $d^2\left(-\frac{b^3\left(\frac{\mathrm{Si}\left(dx+c+\frac{da-cb}{b}\right)\cos\left(\frac{da-cb}{b}\right)}{b}-\frac{\mathrm{Ci}\left(dx+c+\frac{da-cb}{b}\right)\sin\left(\frac{da-cb}{b}\right)}{b}\right)}{d^2a^3}-\frac{b\left(-\frac{\sin(dx+c)}{dx}-\mathrm{Si}(dx)\sin(c)+\mathrm{Ci}(dx)\cos\right.}{a^2d}\right.$ |
| default | $d^2\left(-\frac{b^3\left(\frac{\mathrm{Si}\left(dx+c+\frac{da-cb}{b}\right)\cos\left(\frac{da-cb}{b}\right)}{b}-\frac{\mathrm{Ci}\left(dx+c+\frac{da-cb}{b}\right)\sin\left(\frac{da-cb}{b}\right)}{b}\right)}{d^2a^3}-\frac{b\left(-\frac{\sin(dx+c)}{dx}-\mathrm{Si}(dx)\sin(c)+\mathrm{Ci}(dx)\cos\right.}{a^2d}\right.$ |
| risch | $-\frac{id^2\mathrm{e}^{ic}\,\mathrm{Ei}_1(-idx)}{4a}+\frac{ib^2\mathrm{e}^{ic}\,\mathrm{Ei}_1(-idx)}{2a^3}-\frac{ib^2\mathrm{e}^{-\frac{i(da-cb)}{b}}\,\mathrm{Ei}_1\left(-idx-ic-\frac{iad-icb}{b}\right)}{2a^3}+\frac{db\,\mathrm{e}^{ic}\,\mathrm{Ei}_1(-idx)}{2a^2}+\frac{d\,\mathrm{e}^{-ic}\,\mathrm{Ei}}{2a}$ |

input
```
int(sin(d*x+c)/x^3/(b*x+a),x,method=_RETURNVERBOSE)
```

output
```
d^2*(-1/d^2*b^3/a^3*(Si(d*x+c+(a*d-b*c)/b)*cos((a*d-b*c)/b)/b-Ci(d*x+c+(a*
d-b*c)/b)*sin((a*d-b*c)/b)/b)-b/a^2/d*(-sin(d*x+c)/d/x-Si(d*x)*sin(c)+Ci(d
*x)*cos(c))+b^2/a^3/d^2*(Si(d*x)*cos(c)+Ci(d*x)*sin(c))+1/a*(-1/2*sin(d*x+
c)/d^2/x^2-1/2*cos(d*x+c)/d/x-1/2*Si(d*x)*cos(c)-1/2*Ci(d*x)*sin(c)))
```

### 3.25.5 Fricas [A] (verification not implemented)

Time = 0.28 (sec) , antiderivative size = 186, normalized size of antiderivative = 0.98

$$\int \frac{\sin(c+dx)}{x^3(a+bx)}\,dx$$
$$=\frac{2\,b^2x^2\,\mathrm{Ci}\left(\frac{bdx+ad}{b}\right)\sin\left(-\frac{bc-ad}{b}\right)-2\,b^2x^2\cos\left(-\frac{bc-ad}{b}\right)\mathrm{Si}\left(\frac{bdx+ad}{b}\right)-a^2dx\cos(dx+c)-\left(2\,abdx^2\,\mathrm{Ci}(dx)+\right.}{2}$$

input
```
integrate(sin(d*x+c)/x^3/(b*x+a),x, algorithm="fricas")
```

output
```
1/2*(2*b^2*x^2*cos_integral((b*d*x + a*d)/b)*sin(-(b*c - a*d)/b) - 2*b^2*x
^2*cos(-(b*c - a*d)/b)*sin_integral((b*d*x + a*d)/b) - a^2*d*x*cos(d*x + c
) - (2*a*b*d*x^2*cos_integral(d*x) + (a^2*d^2 - 2*b^2)*x^2*sin_integral(d*
x))*cos(c) + (2*a*b*x - a^2)*sin(d*x + c) + (2*a*b*d*x^2*sin_integral(d*x)
 - (a^2*d^2 - 2*b^2)*x^2*cos_integral(d*x))*sin(c))/(a^3*x^2)
```

## 3.25.6 Sympy [F]

$$\int \frac{\sin(c+dx)}{x^3(a+bx)}\,dx = \int \frac{\sin{(c+dx)}}{x^3\,(a+bx)}\,dx$$

input
```
integrate(sin(d*x+c)/x**3/(b*x+a),x)
```

output
```
Integral(sin(c + d*x)/(x**3*(a + b*x)), x)
```

## 3.25.7 Maxima [F]

$$\int \frac{\sin(c+dx)}{x^3(a+bx)}\,dx = \int \frac{\sin{(dx+c)}}{(bx+a)x^3}\,dx$$

input
```
integrate(sin(d*x+c)/x^3/(b*x+a),x, algorithm="maxima")
```

output
```
integrate(sin(d*x + c)/((b*x + a)*x^3), x)
```

### 3.25.8 Giac [C] (verification not implemented)

Result contains higher order function than in optimal. Order 9 vs. order 4.

Time = 0.35 (sec) , antiderivative size = 4565, normalized size of antiderivative = 24.15

$$\int \frac{\sin(c+dx)}{x^3(a+bx)}\,dx = \text{Too large to display}$$

input
```
integrate(sin(d*x+c)/x^3/(b*x+a),x, algorithm="giac")
```

output
```
1/4*(a^2*d^2*x^2*imag_part(cos_integral(d*x))*tan(1/2*d*x)^2*tan(1/2*c)^2*
tan(1/2*a*d/b)^2 - a^2*d^2*x^2*imag_part(cos_integral(-d*x))*tan(1/2*d*x)^
2*tan(1/2*c)^2*tan(1/2*a*d/b)^2 + 2*a^2*d^2*x^2*sin_integral(d*x)*tan(1/2*
d*x)^2*tan(1/2*c)^2*tan(1/2*a*d/b)^2 - 2*a^2*d^2*x^2*real_part(cos_integra
l(d*x))*tan(1/2*d*x)^2*tan(1/2*c)*tan(1/2*a*d/b)^2 - 2*a^2*d^2*x^2*real_pa
rt(cos_integral(-d*x))*tan(1/2*d*x)^2*tan(1/2*c)*tan(1/2*a*d/b)^2 + 2*a*b*
d*x^2*real_part(cos_integral(d*x))*tan(1/2*d*x)^2*tan(1/2*c)^2*tan(1/2*a*d
/b)^2 + 2*a*b*d*x^2*real_part(cos_integral(-d*x))*tan(1/2*d*x)^2*tan(1/2*c
)^2*tan(1/2*a*d/b)^2 + a^2*d^2*x^2*imag_part(cos_integral(d*x))*tan(1/2*d*
x)^2*tan(1/2*c)^2 - a^2*d^2*x^2*imag_part(cos_integral(-d*x))*tan(1/2*d*x)
^2*tan(1/2*c)^2 + 2*a^2*d^2*x^2*sin_integral(d*x)*tan(1/2*d*x)^2*tan(1/2*c
)^2 - a^2*d^2*x^2*imag_part(cos_integral(d*x))*tan(1/2*d*x)^2*tan(1/2*a*d/
b)^2 + a^2*d^2*x^2*imag_part(cos_integral(-d*x))*tan(1/2*d*x)^2*tan(1/2*a*
d/b)^2 - 2*a^2*d^2*x^2*sin_integral(d*x)*tan(1/2*d*x)^2*tan(1/2*a*d/b)^2 +
 4*a*b*d*x^2*imag_part(cos_integral(d*x))*tan(1/2*d*x)^2*tan(1/2*c)*tan(1/
2*a*d/b)^2 - 4*a*b*d*x^2*imag_part(cos_integral(-d*x))*tan(1/2*d*x)^2*tan(
1/2*c)*tan(1/2*a*d/b)^2 + 8*a*b*d*x^2*sin_integral(d*x)*tan(1/2*d*x)^2*tan
(1/2*c)*tan(1/2*a*d/b)^2 + a^2*d^2*x^2*imag_part(cos_integral(d*x))*tan(1/
2*c)^2*tan(1/2*a*d/b)^2 - a^2*d^2*x^2*imag_part(cos_integral(-d*x))*tan(1/
2*c)^2*tan(1/2*a*d/b)^2 + 2*a^2*d^2*x^2*sin_integral(d*x)*tan(1/2*c)^2*...
```

### 3.25.9 Mupad [F(-1)]

Timed out.

$$\int \frac{\sin(c+dx)}{x^3(a+bx)}\,dx = \int \frac{\sin\left(c+d\,x\right)}{x^3\,\left(a+b\,x\right)}\,dx$$

input
```
int(sin(c + d*x)/(x^3*(a + b*x)),x)
```

output
```
int(sin(c + d*x)/(x^3*(a + b*x)), x)
```

# 3.26 $\int \frac{x^4 \sin(c+dx)}{(a+bx)^2} \, dx$



## 3.26.1 Optimal result

Integrand size = 17, antiderivative size = 233

$$
\begin{aligned}
\int \frac{x^4 \sin(c+dx)}{(a+bx)^2} \, dx = & \frac{2\cos(c+dx)}{b^2d^3} - \frac{3a^2\cos(c+dx)}{b^4d} + \frac{2ax\cos(c+dx)}{b^3d} \\
& - \frac{x^2\cos(c+dx)}{b^2d} + \frac{a^4d\cos\left(c-\frac{ad}{b}\right)\text{CosIntegral}\left(\frac{ad}{b}+dx\right)}{b^6} \\
& - \frac{4a^3\,\text{CosIntegral}\left(\frac{ad}{b}+dx\right)\sin\left(c-\frac{ad}{b}\right)}{b^5} \\
& - \frac{2a\sin(c+dx)}{b^3d^2} + \frac{2x\sin(c+dx)}{b^2d^2} - \frac{a^4\sin(c+dx)}{b^5(a+bx)} \\
& - \frac{4a^3\cos\left(c-\frac{ad}{b}\right)\text{Si}\left(\frac{ad}{b}+dx\right)}{b^5} - \frac{a^4d\sin\left(c-\frac{ad}{b}\right)\text{Si}\left(\frac{ad}{b}+dx\right)}{b^6}
\end{aligned}
$$

output
```
a^4*d*Ci(a*d/b+d*x)*cos(-c+a*d/b)/b^6+2*cos(d*x+c)/b^2/d^3-3*a^2*cos(d*x+c
)/b^4/d+2*a*x*cos(d*x+c)/b^3/d-x^2*cos(d*x+c)/b^2/d-4*a^3*cos(-c+a*d/b)*Si
(a*d/b+d*x)/b^5+4*a^3*Ci(a*d/b+d*x)*sin(-c+a*d/b)/b^5+a^4*d*Si(a*d/b+d*x)*
sin(-c+a*d/b)/b^6-2*a*sin(d*x+c)/b^3/d^2+2*x*sin(d*x+c)/b^2/d^2-a^4*sin(d*
x+c)/b^5/(b*x+a)
```

### 3.26.2 Mathematica [A] (verified)

Time = 0.67 (sec) , antiderivative size = 177, normalized size of antiderivative = 0.76

$$\int \frac{x^4 \sin(c+dx)}{(a+bx)^2} \, dx$$
$$= \frac{a^3 \operatorname{CosIntegral}\left(d\left(\frac{a}{b}+x\right)\right)\left(ad\cos\left(c-\frac{ad}{b}\right)-4b\sin\left(c-\frac{ad}{b}\right)\right)-\frac{b(b(a+bx)(3a^2d^2-2abd^2x+b^2(-2+d^2x^2))\cos(c+dx)+c}{d^3(a+bx)}}{b^6}$$

input
```
Integrate[(x^4*Sin[c + d*x])/(a + b*x)^2,x]
```

output
```
(a^3*CosIntegral[d*(a/b + x)]*(a*d*Cos[c - (a*d)/b] - 4*b*Sin[c - (a*d)/b]
) - (b*(b*(a + b*x)*(3*a^2*d^2 - 2*a*b*d^2*x + b^2*(-2 + d^2*x^2))*Cos[c +
 d*x] + d*(2*a^2*b^2 + a^4*d^2 - 2*b^4*x^2)*Sin[c + d*x]))/(d^3*(a + b*x))
 - a^3*(4*b*Cos[c - (a*d)/b] + a*d*Sin[c - (a*d)/b])*SinIntegral[d*(a/b +
x)])/b^6
```

### 3.26.3 Rubi [A] (verified)

Time = 0.73 (sec) , antiderivative size = 233, normalized size of antiderivative = 1.00, number of steps used = 2, number of rules used = 2, $\frac{\text{number of rules}}{\text{integrand size}}$ = 0.118, Rules used = {7293, 2009}

Below are the steps used by Rubi to obtain the solution. The rule number used for the transformation is given above next to the arrow. The rules definitions used are listed below.

$$\int \frac{x^4 \sin(c+dx)}{(a+bx)^2} \, dx$$
$$\Big\downarrow \text{7293}$$
$$\int \left(\frac{a^4 \sin(c+dx)}{b^4(a+bx)^2}-\frac{4a^3 \sin(c+dx)}{b^4(a+bx)}+\frac{3a^2 \sin(c+dx)}{b^4}-\frac{2ax \sin(c+dx)}{b^3}+\frac{x^2 \sin(c+dx)}{b^2}\right)dx$$
$$\Big\downarrow \text{2009}$$
$$\frac{a^4 d \cos\left(c-\frac{ad}{b}\right) \operatorname{CosIntegral}\left(xd+\frac{ad}{b}\right)}{b^6}-\frac{a^4 d \sin\left(c-\frac{ad}{b}\right) \operatorname{Si}\left(xd+\frac{ad}{b}\right)}{b^6}-\frac{a^4 \sin(c+dx)}{b^5(a+bx)}-\frac{4a^3 \sin\left(c-\frac{ad}{b}\right) \operatorname{CosIntegral}\left(xd+\frac{ad}{b}\right)}{b^5}-\frac{4a^3 \cos\left(c-\frac{ad}{b}\right) \operatorname{Si}\left(xd+\frac{ad}{b}\right)}{b^5}-\frac{3a^2 \cos(c+dx)}{b^4 d}-\frac{2a \sin(c+dx)}{b^3 d^2}+\frac{2ax \cos(c+dx)}{b^3 d}+\frac{2\cos(c+dx)}{b^2 d^3}+\frac{2x \sin(c+dx)}{b^2 d^2}-\frac{x^2 \cos(c+dx)}{b^2 d}$$

input
```
Int[(x^4*Sin[c + d*x])/(a + b*x)^2,x]
```

output
```
(2*Cos[c + d*x])/(b^2*d^3) - (3*a^2*Cos[c + d*x])/(b^4*d) + (2*a*x*Cos[c +
 d*x])/(b^3*d) - (x^2*Cos[c + d*x])/(b^2*d) + (a^4*d*Cos[c - (a*d)/b]*CosI
ntegral[(a*d)/b + d*x])/b^6 - (4*a^3*CosIntegral[(a*d)/b + d*x]*Sin[c - (a
*d)/b])/b^5 - (2*a*Sin[c + d*x])/(b^3*d^2) + (2*x*Sin[c + d*x])/(b^2*d^2)
- (a^4*Sin[c + d*x])/(b^5*(a + b*x)) - (4*a^3*Cos[c - (a*d)/b]*SinIntegral
[(a*d)/b + d*x])/b^5 - (a^4*d*Sin[c - (a*d)/b]*SinIntegral[(a*d)/b + d*x])
/b^6
```

### 3.26.3.1 Defintions of rubi rules used

rule 2009
```
Int[u_, x_Symbol] :> Simp[IntSum[u, x], x] /; SumQ[u]
```

rule 7293
```
Int[u_, x_Symbol] :> With[{v = ExpandIntegrand[u, x]}, Int[v, x] /; SumQ[v]
]
```

## 3.26.4 Maple [C] (verified)

Result contains complex when optimal does not.

Time = 0.48 (sec) , antiderivative size = 734, normalized size of antiderivative = 3.15

| method | result |
|---|---|
| risch | $-\frac{i\left(-2ib^6d^5x^5+4ia\,b^5d^5x^4-6ib^6c\,d^4x^4-8ia^3b^3d^5x^2+10ia^4b^2d^5x-24ia^3b^3c\,d^4x+4ib^6d^3x^3+12ia^5b\,d^5-18ia^4b^2c\,d^4+1\right.}{2b^5d^4(bx+a)(-dxb-da)(-dxb+2da-3cb)}$ |
| derivativedivides | Expression too large to display |
| default | Expression too large to display |

input
```
int(x^4*sin(d*x+c)/(b*x+a)^2,x,method=_RETURNVERBOSE)
```

output
```
-1/2*I/b^5/d^4*(-8*I*a^3*b^3*d^5*x^2+4*I*a*b^5*d^5*x^4-6*I*b^6*c*d^4*x^4+1
0*I*a^4*b^2*d^5*x-18*I*a^4*b^2*c*d^4+12*I*b^6*c*d^2*x^2+24*I*a*b^5*c*d^2*x
-24*I*a^3*b^3*c*d^4*x+4*I*b^6*d^3*x^3+12*I*a^5*b*d^5-8*I*a^3*b^3*d^3-2*I*b
^6*d^5*x^5-12*I*a^2*b^4*d^3*x+12*I*a^2*b^4*c*d^2)/(b*x+a)/(-b*d*x-a*d)/(-b
*d*x+2*a*d-3*b*c)*cos(d*x+c)+1/2/b^5/d^4*(-2*a^4*b^2*d^6*x^2+4*b^6*d^4*x^4
+2*a^5*b*d^6*x-6*a^4*b^2*c*d^5*x-4*a*b^5*d^4*x^3+12*b^6*c*d^3*x^3+4*a^6*d^
6-6*a^5*b*c*d^5-12*a^2*b^4*d^4*x^2+12*a*b^5*c*d^3*x^2+4*a^3*b^3*d^4*x-12*a
^2*b^4*c*d^3*x+8*a^4*b^2*d^4-12*a^3*b^3*c*d^3)/(b*x+a)/(-b*d*x-a*d)/(-b*d*
x+2*a*d-3*b*c)*sin(d*x+c)-2*I/b^5*cos((a*d-b*c)/b)*Ei(1,-I*d*(b*x+a)/b)*a^
3-1/2*d/b^6*cos((a*d-b*c)/b)*Ei(1,-I*d*(b*x+a)/b)*a^4+2*I/b^5*cos((a*d-b*c
)/b)*Ei(1,I*d*(b*x+a)/b)*a^3-1/2*d/b^6*cos((a*d-b*c)/b)*Ei(1,I*d*(b*x+a)/b
)*a^4-2/b^5*sin((a*d-b*c)/b)*Ei(1,-I*d*(b*x+a)/b)*a^3+1/2*I*d/b^6*sin((a*d
-b*c)/b)*Ei(1,-I*d*(b*x+a)/b)*a^4-2/b^5*sin((a*d-b*c)/b)*Ei(1,I*d*(b*x+a)/
b)*a^3-1/2*I*d/b^6*sin((a*d-b*c)/b)*Ei(1,I*d*(b*x+a)/b)*a^4
```

### 3.26.5 Fricas [A] (verification not implemented)

Time = 0.30 (sec) , antiderivative size = 287, normalized size of antiderivative = 1.23

$$\int \frac{x^4 \sin(c+dx)}{(a+bx)^2}\, dx =$$
$$-\frac{(b^5d^2x^3 - ab^4d^2x^2 + 3\,a^3b^2d^2 - 2\,ab^4 + (a^2b^3d^2 - 2\,b^5)x)\cos\left(dx+c\right) - \left((a^4bd^4x + a^5d^4)\,\mathrm{Ci}\left(\frac{bdx+ad}{b}\right) - \right.}{}$$

input
```
integrate(x^4*sin(d*x+c)/(b*x+a)^2,x, algorithm="fricas")
```

output
```
-((b^5*d^2*x^3 - a*b^4*d^2*x^2 + 3*a^3*b^2*d^2 - 2*a*b^4 + (a^2*b^3*d^2 -
2*b^5)*x)*cos(d*x + c) - ((a^4*b*d^4*x + a^5*d^4)*cos_integral((b*d*x + a*
d)/b) - 4*(a^3*b^2*d^3*x + a^4*b*d^3)*sin_integral((b*d*x + a*d)/b))*cos(-
(b*c - a*d)/b) + (a^4*b*d^3 - 2*b^5*d*x^2 + 2*a^2*b^3*d)*sin(d*x + c) - (4
*(a^3*b^2*d^3*x + a^4*b*d^3)*cos_integral((b*d*x + a*d)/b) + (a^5*d^4*x
+ a^5*d^4)*sin_integral((b*d*x + a*d)/b))*sin(-(b*c - a*d)/b))/(b^7*d^3*x
+ a*b^6*d^3)
```

### 3.26.6 Sympy [F]

$$\int \frac{x^4 \sin(c+dx)}{(a+bx)^2}\,dx = \int \frac{x^4 \sin{(c+dx)}}{(a+bx)^2}\,dx$$

input
```
integrate(x**4*sin(d*x+c)/(b*x+a)**2,x)
```

output
```
Integral(x**4*sin(c + d*x)/(a + b*x)**2, x)
```

### 3.26.7 Maxima [F]

$$\int \frac{x^4 \sin(c+dx)}{(a+bx)^2}\,dx = \int \frac{x^4 \sin{(dx+c)}}{(bx+a)^2}\,dx$$

input
```
integrate(x^4*sin(d*x+c)/(b*x+a)^2,x, algorithm="maxima")
```

output
```
1/2*(2*((2*a^2*b*(exp_integral_e(3, (I*b*d*x + I*a*d)/b) + exp_integral_e(
3, -(I*b*d*x + I*a*d)/b))*cos(c)^2 + 2*a^2*b*(exp_integral_e(3, (I*b*d*x +
 I*a*d)/b) + exp_integral_e(3, -(I*b*d*x + I*a*d)/b))*sin(c)^2 + (a^3*(-I*
exp_integral_e(3, (I*b*d*x + I*a*d)/b) + I*exp_integral_e(3, -(I*b*d*x + I
*a*d)/b))*cos(c)^2 + a^3*(-I*exp_integral_e(3, (I*b*d*x + I*a*d)/b) + I*ex
p_integral_e(3, -(I*b*d*x + I*a*d)/b))*sin(c)^2)*d)*cos(-(b*c - a*d)/b) +
(2*a^2*b*(I*exp_integral_e(3, (I*b*d*x + I*a*d)/b) - I*exp_integral_e(3, -
(I*b*d*x + I*a*d)/b))*cos(c)^2 + 2*a^2*b*(I*exp_integral_e(3, (I*b*d*x + I
*a*d)/b) - I*exp_integral_e(3, -(I*b*d*x + I*a*d)/b))*sin(c)^2 + (a^3*(exp
_integral_e(3, (I*b*d*x + I*a*d)/b) + exp_integral_e(3, -(I*b*d*x + I*a*d)
/b))*cos(c)^2 + a^3*(exp_integral_e(3, (I*b*d*x + I*a*d)/b) + exp_integral
_e(3, -(I*b*d*x + I*a*d)/b))*sin(c)^2)*d)*sin(-(b*c - a*d)/b))*cos(d*x + c
)^2 + 2*((2*a^2*b*(exp_integral_e(3, (I*b*d*x + I*a*d)/b) + exp_integral_e
(3, -(I*b*d*x + I*a*d)/b))*cos(c)^2 + 2*a^2*b*(exp_integral_e(3, (I*b*d*x
+ I*a*d)/b) + exp_integral_e(3, -(I*b*d*x + I*a*d)/b))*sin(c)^2 + (a^3*(-I
*exp_integral_e(3, (I*b*d*x + I*a*d)/b) + I*exp_integral_e(3, -(I*b*d*x +
I*a*d)/b))*cos(c)^2 + a^3*(-I*exp_integral_e(3, (I*b*d*x + I*a*d)/b) + I*e
xp_integral_e(3, -(I*b*d*x + I*a*d)/b))*sin(c)^2)*d)*cos(-(b*c - a*d)/b) +
 (2*a^2*b*(I*exp_integral_e(3, (I*b*d*x + I*a*d)/b) - I*exp_integral_e(3,
-(I*b*d*x + I*a*d)/b))*cos(c)^2 + 2*a^2*b*(I*exp_integral_e(3, (I*b*d*x...
```

### 3.26.8 Giac [B] (verification not implemented)

Leaf count of result is larger than twice the leaf count of optimal. 1973 vs. 2(236) = 472.

Time = 0.37 (sec) , antiderivative size = 1973, normalized size of antiderivative = 8.47

$$\int \frac{x^4 \sin(c+dx)}{(a+bx)^2} dx = \text{Too large to display}$$

input
```
integrate(x^4*sin(d*x+c)/(b*x+a)^2,x, algorithm="giac")
```

output
```
((b*x + a)*a^4*(b*c/(b*x + a) - a*d/(b*x + a) + d)*d^4*cos(-(b*c - a*d)/b)
*cos_integral(((b*x + a)*(b*c/(b*x + a) - a*d/(b*x + a) + d) - b*c + a*d)/
b) - a^4*b*c*d^4*cos(-(b*c - a*d)/b)*cos_integral(((b*x + a)*(b*c/(b*x + a
) - a*d/(b*x + a) + d) - b*c + a*d)/b) + a^5*d^5*cos(-(b*c - a*d)/b)*cos_i
ntegral(((b*x + a)*(b*c/(b*x + a) - a*d/(b*x + a) + d) - b*c + a*d)/b) + (
b*x + a)*a^4*(b*c/(b*x + a) - a*d/(b*x + a) + d)*d^4*sin(-(b*c - a*d)/b)*s
in_integral(((b*x + a)*(b*c/(b*x + a) - a*d/(b*x + a) + d) - b*c + a*d)/b)
 - a^4*b*c*d^4*sin(-(b*c - a*d)/b)*sin_integral(((b*x + a)*(b*c/(b*x + a)
- a*d/(b*x + a) + d) - b*c + a*d)/b) + a^5*d^5*sin(-(b*c - a*d)/b)*sin_int
egral(((b*x + a)*(b*c/(b*x + a) - a*d/(b*x + a) + d) - b*c + a*d)/b) + 4*(
b*x + a)*a^3*b*(b*c/(b*x + a) - a*d/(b*x + a) + d)*d^3*cos_integral(((b*x
+ a)*(b*c/(b*x + a) - a*d/(b*x + a) + d) - b*c + a*d)/b)*sin(-(b*c - a*d)/
b) - 4*a^3*b^2*c*d^3*cos_integral(((b*x + a)*(b*c/(b*x + a) - a*d/(b*x + a
) + d) - b*c + a*d)/b)*sin(-(b*c - a*d)/b) + 4*a^4*b*d^4*cos_integral(((b*
x + a)*(b*c/(b*x + a) - a*d/(b*x + a) + d) - b*c + a*d)/b)*sin(-(b*c - a*d
)/b) - 4*(b*x + a)*a^3*b*(b*c/(b*x + a) - a*d/(b*x + a) + d)*d^3*cos(-(b*c
 - a*d)/b)*sin_integral(((b*x + a)*(b*c/(b*x + a) - a*d/(b*x + a) + d) - b
*c + a*d)/b) + 4*a^3*b^2*c*d^3*cos(-(b*c - a*d)/b)*sin_integral(((b*x + a)
*(b*c/(b*x + a) - a*d/(b*x + a) + d) - b*c + a*d)/b) - 4*a^4*b*d^4*cos(-(b
*c - a*d)/b)*sin_integral(((b*x + a)*(b*c/(b*x + a) - a*d/(b*x + a) + d...
```

### 3.26.9 Mupad [F(-1)]

Timed out.

$$\int \frac{x^4 \sin(c+dx)}{(a+bx)^2} dx = \int \frac{x^4 \sin(c+dx)}{(a+bx)^2} dx$$

input
```
int((x^4*sin(c + d*x))/(a + b*x)^2,x)
```

output
```
int((x^4*sin(c + d*x))/(a + b*x)^2, x)
```

# 3.27 $\int \frac{x^3 \sin(c+dx)}{(a+bx)^2} \, dx$



## 3.27.1 Optimal result

Integrand size = 17, antiderivative size = 181

$$\begin{aligned}\int \frac{x^3 \sin(c+dx)}{(a+bx)^2} \, dx = & \frac{2a\cos(c+dx)}{b^3 d} - \frac{x\cos(c+dx)}{b^2 d} \\ & - \frac{a^3 d \cos\left(c-\frac{ad}{b}\right) \operatorname{CosIntegral}\left(\frac{ad}{b}+dx\right)}{b^5} \\ & + \frac{3a^2 \operatorname{CosIntegral}\left(\frac{ad}{b}+dx\right) \sin\left(c-\frac{ad}{b}\right)}{b^4} + \frac{\sin(c+dx)}{b^2 d^2} \\ & + \frac{a^3 \sin(c+dx)}{b^4(a+bx)} + \frac{3a^2 \cos\left(c-\frac{ad}{b}\right) \operatorname{Si}\left(\frac{ad}{b}+dx\right)}{b^4} \\ & + \frac{a^3 d \sin\left(c-\frac{ad}{b}\right) \operatorname{Si}\left(\frac{ad}{b}+dx\right)}{b^5}\end{aligned}$$

output
```
-a^3*d*Ci(a*d/b+d*x)*cos(-c+a*d/b)/b^5+2*a*cos(d*x+c)/b^3/d-x*cos(d*x+c)/b
^2/d+3*a^2*cos(-c+a*d/b)*Si(a*d/b+d*x)/b^4-3*a^2*Ci(a*d/b+d*x)*sin(-c+a*d/
b)/b^4-a^3*d*Si(a*d/b+d*x)*sin(-c+a*d/b)/b^5+sin(d*x+c)/b^2/d^2+a^3*sin(d*
x+c)/b^4/(b*x+a)
```

### 3.27.2 Mathematica [A] (verified)

Time = 0.58 (sec) , antiderivative size = 153, normalized size of antiderivative = 0.85

$$\int \frac{x^3 \sin(c+dx)}{(a+bx)^2} \, dx$$
$$= \frac{-a^2 \operatorname{CosIntegral}\left(d\left(\frac{a}{b}+x\right)\right)\left(ad\cos\left(c-\frac{ad}{b}\right)-3b\sin\left(c-\frac{ad}{b}\right)\right)+\frac{b\left(bd\left(2a^2+abx-b^2x^2\right)\cos(c+dx)+\left(ab^2+a^3d^2+b^3x\right)\sin(c+dx)\right)}{d^2(a+bx)}}{b^5}$$

input
```
Integrate[(x^3*Sin[c + d*x])/(a + b*x)^2,x]
```

output
```
(-(a^2*CosIntegral[d*(a/b + x)]*(a*d*Cos[c - (a*d)/b] - 3*b*Sin[c - (a*d)/
b])) + (b*(b*d*(2*a^2 + a*b*x - b^2*x^2)*Cos[c + d*x] + (a*b^2 + a^3*d^2 +
 b^3*x)*Sin[c + d*x]))/(d^2*(a + b*x)) + a^2*(3*b*Cos[c - (a*d)/b] + a*d*S
in[c - (a*d)/b])*SinIntegral[d*(a/b + x)])/b^5
```

### 3.27.3 Rubi [A] (verified)

Time = 0.62 (sec) , antiderivative size = 181, normalized size of antiderivative = 1.00, number of steps used = 2, number of rules used = 2, $\frac{\text{number of rules}}{\text{integrand size}}$ = 0.118, Rules used = {7293, 2009}

Below are the steps used by Rubi to obtain the solution. The rule number used for the transformation is given above next to the arrow. The rules definitions used are listed below.

$$\int \frac{x^3 \sin(c+dx)}{(a+bx)^2} \, dx$$
$$\Big\downarrow \text{ 7293}$$
$$\int \left(-\frac{a^3 \sin(c+dx)}{b^3(a+bx)^2}+\frac{3a^2 \sin(c+dx)}{b^3(a+bx)}-\frac{2a \sin(c+dx)}{b^3}+\frac{x \sin(c+dx)}{b^2}\right)dx$$
$$\Big\downarrow \text{ 2009}$$
$$-\frac{a^3 d \cos\left(c-\frac{ad}{b}\right) \operatorname{CosIntegral}\left(xd+\frac{ad}{b}\right)}{b^5}+\frac{a^3 d \sin\left(c-\frac{ad}{b}\right) \operatorname{Si}\left(xd+\frac{ad}{b}\right)}{b^5}+\frac{a^3 \sin(c+dx)}{b^4(a+bx)}+\frac{3a^2 \sin\left(c-\frac{ad}{b}\right) \operatorname{CosIntegral}\left(xd+\frac{ad}{b}\right)}{b^4}+\frac{3a^2 \cos\left(c-\frac{ad}{b}\right) \operatorname{Si}\left(xd+\frac{ad}{b}\right)}{b^4}+\frac{2a \cos(c+dx)}{b^3 d}+\frac{\sin(c+dx)}{b^2 d^2}-\frac{x \cos(c+dx)}{b^2 d}$$

input
```
Int[(x^3*Sin[c + d*x])/(a + b*x)^2,x]
```

output
```
(2*a*Cos[c + d*x])/(b^3*d) - (x*Cos[c + d*x])/(b^2*d) - (a^3*d*Cos[c - (a*
d)/b]*CosIntegral[(a*d)/b + d*x])/b^5 + (3*a^2*CosIntegral[(a*d)/b + d*x]*
Sin[c - (a*d)/b])/b^4 + Sin[c + d*x]/(b^2*d^2) + (a^3*Sin[c + d*x])/(b^4*(
a + b*x)) + (3*a^2*Cos[c - (a*d)/b]*SinIntegral[(a*d)/b + d*x])/b^4 + (a^3
*d*Sin[c - (a*d)/b]*SinIntegral[(a*d)/b + d*x])/b^5
```

### 3.27.3.1 Defintions of rubi rules used

rule 2009
```
Int[u_, x_Symbol] :> Simp[IntSum[u, x], x] /; SumQ[u]
```

rule 7293
```
Int[u_, x_Symbol] :> With[{v = ExpandIntegrand[u, x]}, Int[v, x] /; SumQ[v]
]
```

## 3.27.4 Maple [C] (verified)

Result contains complex when optimal does not.

Time = 0.41 (sec) , antiderivative size = 607, normalized size of antiderivative = 3.35

| method | result |
|---|---|
| risch | $-\frac{i\left(-2ib^4d^3x^4+4iab^3d^3x^3-6ib^4cd^2x^3+6ia^2b^2d^3x^2-8ia^3bd^3x+18ia^2b^2cd^2x-8ia^4d^3+12ia^3bcd^2\right)\cos(dx+c)}{2d^2b^3(bx+a)(-dxb+2da-3cb)(-dxb-da)}+\frac{(2\cdots}{}$ |
| derivativedivides | $\frac{-d^2c^3\left(-\frac{\sin(dx+c)}{(da-cb+b(dx+c))b}+\frac{\frac{\mathrm{Si}\left(dx+c+\frac{da-cb}{b}\right)\sin\left(\frac{da-cb}{b}\right)}{b}+\frac{\mathrm{Ci}\left(dx+c+\frac{da-cb}{b}\right)\cos\left(\frac{da-cb}{b}\right)}{b}}{b}\right)+\frac{3d^2c^2\left(\frac{\mathrm{Si}\left(dx+c+\frac{da-cb}{b}\right)\cdots}{b}\cdots\right.}{\cdots}\cdots}{\cdots}$ |
| default | $\frac{-d^2c^3\left(-\frac{\sin(dx+c)}{(da-cb+b(dx+c))b}+\frac{\frac{\mathrm{Si}\left(dx+c+\frac{da-cb}{b}\right)\sin\left(\frac{da-cb}{b}\right)}{b}+\frac{\mathrm{Ci}\left(dx+c+\frac{da-cb}{b}\right)\cos\left(\frac{da-cb}{b}\right)}{b}}{b}\right)+\frac{3d^2c^2\left(\frac{\mathrm{Si}\left(dx+c+\frac{da-cb}{b}\right)\cdots}{b}\cdots\right.}{\cdots}\cdots}{\cdots}$ |

input
```
int(x^3*sin(d*x+c)/(b*x+a)^2,x,method=_RETURNVERBOSE)
```

output
```
-1/2*I/d^2/b^3*(18*I*a^2*b^2*c*d^2*x-2*I*b^4*d^3*x^4-8*I*a^4*d^3+4*I*a*b^3
*d^3*x^3-6*I*b^4*c*d^2*x^3+6*I*a^2*b^2*d^3*x^2-8*I*a^3*b*d^3*x+12*I*a^3*b*
c*d^2)/(b*x+a)/(-b*d*x+2*a*d-3*b*c)/(-b*d*x-a*d)*cos(d*x+c)+1/2/d^2/b^4*(2
*a^3*b^2*d^4*x^2-2*a^4*b*d^4*x+6*a^3*b^2*c*d^3*x+2*b^5*d^2*x^3-4*a^5*d^4+6
*a^4*b*c*d^3+6*b^5*c*d*x^2-6*a^2*b^3*d^2*x+12*a*b^4*c*d*x-4*a^3*b^2*d^2+6*
a^2*b^3*c*d)/(b*x+a)/(-b*d*x+2*a*d-3*b*c)/(-b*d*x-a*d)*sin(d*x+c)+1/2*d/b^
5*cos((a*d-b*c)/b)*Ei(1,I*d*(b*x+a)/b)*a^3+1/2*d/b^5*cos((a*d-b*c)/b)*Ei(1
,-I*d*(b*x+a)/b)*a^3-3/2*I/b^4*cos((a*d-b*c)/b)*Ei(1,I*d*(b*x+a)/b)*a^2+3/
2*I/b^4*cos((a*d-b*c)/b)*Ei(1,-I*d*(b*x+a)/b)*a^2+1/2*I*d/b^5*sin((a*d-b*c
)/b)*Ei(1,I*d*(b*x+a)/b)*a^3-1/2*I*d/b^5*sin((a*d-b*c)/b)*Ei(1,-I*d*(b*x+a
)/b)*a^3+3/2/b^4*sin((a*d-b*c)/b)*Ei(1,I*d*(b*x+a)/b)*a^2+3/2/b^4*sin((a*d
-b*c)/b)*Ei(1,-I*d*(b*x+a)/b)*a^2
```

### 3.27.5 Fricas [A] (verification not implemented)

Time = 0.29 (sec) , antiderivative size = 246, normalized size of antiderivative = 1.36

$$\int \frac{x^3\sin(c+dx)}{(a+bx)^2}\,dx = -\frac{(b^4dx^2-ab^3dx-2\,a^2b^2d)\cos(dx+c)+\left((a^3bd^3x+a^4d^3)\operatorname{Ci}\left(\frac{bdx+ad}{b}\right)-3\,(a^2b^2d^2x+a^3bd^2)\operatorname{Si}\left(\frac{bdx+ad}{b}\right.\right.}{}$$

input
```
integrate(x^3*sin(d*x+c)/(b*x+a)^2,x, algorithm="fricas")
```

output
```
-((b^4*d*x^2 - a*b^3*d*x - 2*a^2*b^2*d)*cos(d*x + c) + ((a^3*b*d^3*x + a^4
*d^3)*cos_integral((b*d*x + a*d)/b) - 3*(a^2*b^2*d^2*x + a^3*b*d^2)*sin_in
tegral((b*d*x + a*d)/b))*cos(-(b*c - a*d)/b) - (a^3*b*d^2 + b^4*x + a*b^3)
*sin(d*x + c) + (3*(a^2*b^2*d^2*x + a^3*b*d^2)*cos_integral((b*d*x + a*d)/
b) + (a^3*b*d^3*x + a^4*d^3)*sin_integral((b*d*x + a*d)/b))*sin(-(b*c - a*
d)/b))/(b^6*d^2*x + a*b^5*d^2)
```

### 3.27.6 Sympy [F]

$$\int \frac{x^3 \sin(c+dx)}{(a+bx)^2} \, dx = \int \frac{x^3 \sin{(c+dx)}}{(a+bx)^2} \, dx$$

input
```
integrate(x**3*sin(d*x+c)/(b*x+a)**2,x)
```

output
```
Integral(x**3*sin(c + d*x)/(a + b*x)**2, x)
```

### 3.27.7 Maxima [F]

$$\int \frac{x^3 \sin(c+dx)}{(a+bx)^2} \, dx = \int \frac{x^3 \sin{(dx+c)}}{(bx+a)^2} \, dx$$

input
```
integrate(x^3*sin(d*x+c)/(b*x+a)^2,x, algorithm="maxima")
```

output
```
-1/2*((b^2*cos(c)^2 + b^2*sin(c)^2)*d*x^3*cos(d*x + c) - 2*((a^2*(I*exp_in
tegral_e(3, (I*b*d*x + I*a*d)/b) - I*exp_integral_e(3, -(I*b*d*x + I*a*d)/
b))*cos(c)^2 + a^2*(I*exp_integral_e(3, (I*b*d*x + I*a*d)/b) - I*exp_integ
ral_e(3, -(I*b*d*x + I*a*d)/b))*sin(c)^2)*cos(-(b*c - a*d)/b) - (a^2*(exp_
integral_e(3, (I*b*d*x + I*a*d)/b) + exp_integral_e(3, -(I*b*d*x + I*a*d)/
b))*cos(c)^2 + a^2*(exp_integral_e(3, (I*b*d*x + I*a*d)/b) + exp_integral_
e(3, -(I*b*d*x + I*a*d)/b))*sin(c)^2)*sin(-(b*c - a*d)/b))*cos(d*x + c)^2
- 2*((a^2*(I*exp_integral_e(3, (I*b*d*x + I*a*d)/b) - I*exp_integral_e(3,
-(I*b*d*x + I*a*d)/b))*cos(c)^2 + a^2*(I*exp_integral_e(3, (I*b*d*x + I*a*
d)/b) - I*exp_integral_e(3, -(I*b*d*x + I*a*d)/b))*sin(c)^2)*cos(-(b*c - a
*d)/b) - (a^2*(exp_integral_e(3, (I*b*d*x + I*a*d)/b) + exp_integral_e(3,
-(I*b*d*x + I*a*d)/b))*cos(c)^2 + a^2*(exp_integral_e(3, (I*b*d*x + I*a*d)
/b) + exp_integral_e(3, -(I*b*d*x + I*a*d)/b))*sin(c)^2)*sin(-(b*c - a*d)/
b))*sin(d*x + c)^2 + ((b^2*d*x^3*cos(c) + b^2*x^2*sin(c) + 2*a*b*x*sin(c))
*cos(d*x + c)^2 + (b^2*d*x^3*cos(c) + b^2*x^2*sin(c) + 2*a*b*x*sin(c))*sin
(d*x + c)^2)*cos(d*x + 2*c) + 2*(((a^2*b^4*cos(c)^2 + a^2*b^4*sin(c)^2)*d^
3*x^2 + 2*(a^3*b^3*cos(c)^2 + a^3*b^3*sin(c)^2)*d^3*x + (a^4*b^2*cos(c)^2
+ a^4*b^2*sin(c)^2)*d^3)*cos(d*x + c)^2 + ((a^2*b^4*cos(c)^2 + a^2*b^4*sin
(c)^2)*d^3*x^2 + 2*(a^3*b^3*cos(c)^2 + a^3*b^3*sin(c)^2)*d^3*x + (a^4*b^2*
cos(c)^2 + a^4*b^2*sin(c)^2)*d^3)*sin(d*x + c)^2)*integrate(x*cos(d*x +...
```

### 3.27.8 Giac [B] (verification not implemented)

Leaf count of result is larger than twice the leaf count of optimal. 1474 vs. $2(186) = 372$.

Time = 0.38 (sec) , antiderivative size = 1474, normalized size of antiderivative = 8.14

$$\int \frac{x^3 \sin(c+dx)}{(a+bx)^2} \, dx = \text{Too large to display}$$

input
```
integrate(x^3*sin(d*x+c)/(b*x+a)^2,x, algorithm="giac")
```

output
```
-((b*x + a)*a^3*(b*c/(b*x + a) - a*d/(b*x + a) + d)*d^3*cos(-(b*c - a*d)/b
)*cos_integral(((b*x + a)*(b*c/(b*x + a) - a*d/(b*x + a) + d) - b*c + a*d)
/b) - a^3*b*c*d^3*cos(-(b*c - a*d)/b)*cos_integral(((b*x + a)*(b*c/(b*x +
a) - a*d/(b*x + a) + d) - b*c + a*d)/b) + a^4*d^4*cos(-(b*c - a*d)/b)*cos_
integral(((b*x + a)*(b*c/(b*x + a) - a*d/(b*x + a) + d) - b*c + a*d)/b) +
(b*x + a)*a^3*(b*c/(b*x + a) - a*d/(b*x + a) + d)*d^3*sin(-(b*c - a*d)/b)*
sin_integral(((b*x + a)*(b*c/(b*x + a) - a*d/(b*x + a) + d) - b*c + a*d)/b
) - a^3*b*c*d^3*sin(-(b*c - a*d)/b)*sin_integral(((b*x + a)*(b*c/(b*x + a)
 - a*d/(b*x + a) + d) - b*c + a*d)/b) + a^4*d^4*sin(-(b*c - a*d)/b)*sin_in
tegral(((b*x + a)*(b*c/(b*x + a) - a*d/(b*x + a) + d) - b*c + a*d)/b) + 3*
(b*x + a)*a^2*b*(b*c/(b*x + a) - a*d/(b*x + a) + d)*d^2*cos_integral(((b*x
 + a)*(b*c/(b*x + a) - a*d/(b*x + a) + d) - b*c + a*d)/b)*sin(-(b*c - a*d)
/b) - 3*a^2*b^2*c*d^2*cos_integral(((b*x + a)*(b*c/(b*x + a) - a*d/(b*x +
a) + d) - b*c + a*d)/b)*sin(-(b*c - a*d)/b) + 3*a^3*b*d^3*cos_integral(((b
*x + a)*(b*c/(b*x + a) - a*d/(b*x + a) + d) - b*c + a*d)/b)*sin(-(b*c - a*
d)/b) - 3*(b*x + a)*a^2*b*(b*c/(b*x + a) - a*d/(b*x + a) + d)*d^2*cos(-(b*
c - a*d)/b)*sin_integral(((b*x + a)*(b*c/(b*x + a) - a*d/(b*x + a) + d) -
b*c + a*d)/b) + 3*a^2*b^2*c*d^2*cos(-(b*c - a*d)/b)*sin_integral(((b*x + a
)*(b*c/(b*x + a) - a*d/(b*x + a) + d) - b*c + a*d)/b) - 3*a^3*b*d^3*cos(-(
b*c - a*d)/b)*sin_integral(((b*x + a)*(b*c/(b*x + a) - a*d/(b*x + a) + ...
```

### 3.27.9 Mupad [F(-1)]

Timed out.

$$\int \frac{x^3 \sin(c+dx)}{(a+bx)^2} \, dx = \int \frac{x^3 \sin(c+d\,x)}{(a+b\,x)^2} \, dx$$

input
```
int((x^3*sin(c + d*x))/(a + b*x)^2,x)
```

output
```
int((x^3*sin(c + d*x))/(a + b*x)^2, x)
```

# 3.28 $\int \frac{x^2 \sin(c+dx)}{(a+bx)^2} dx$



## 3.28.1 Optimal result

Integrand size = 17, antiderivative size = 149

$$\int \frac{x^2 \sin(c+dx)}{(a+bx)^2} dx = -\frac{\cos(c+dx)}{b^2 d} + \frac{a^2 d \cos\left(c-\frac{ad}{b}\right) \text{CosIntegral}\left(\frac{ad}{b}+dx\right)}{b^4} - \frac{2a \,\text{CosIntegral}\left(\frac{ad}{b}+dx\right) \sin\left(c-\frac{ad}{b}\right)}{b^3} - \frac{a^2 \sin(c+dx)}{b^3(a+bx)} - \frac{2a \cos\left(c-\frac{ad}{b}\right) \text{Si}\left(\frac{ad}{b}+dx\right)}{b^3} - \frac{a^2 d \sin\left(c-\frac{ad}{b}\right) \text{Si}\left(\frac{ad}{b}+dx\right)}{b^4}$$

output
```
a^2*d*Ci(a*d/b+d*x)*cos(-c+a*d/b)/b^4-cos(d*x+c)/b^2/d-2*a*cos(-c+a*d/b)*S
i(a*d/b+d*x)/b^3+2*a*Ci(a*d/b+d*x)*sin(-c+a*d/b)/b^3+a^2*d*Si(a*d/b+d*x)*s
in(-c+a*d/b)/b^4-a^2*sin(d*x+c)/b^3/(b*x+a)
```

## 3.28.2 Mathematica [A] (verified)

Time = 0.53 (sec) , antiderivative size = 117, normalized size of antiderivative = 0.79

$$\int \frac{x^2 \sin(c+dx)}{(a+bx)^2} dx = \frac{a \,\text{CosIntegral}\left(d\left(\frac{a}{b}+x\right)\right)\left(ad\cos\left(c-\frac{ad}{b}\right)-2b\sin\left(c-\frac{ad}{b}\right)\right)+b\left(-\frac{b\cos(c+dx)}{d}-\frac{a^2\sin(c+dx)}{a+bx}\right)-a\left(2b\cos\left(c-\right.\right.}{b^4}$$

input
```
Integrate[(x^2*Sin[c + d*x])/(a + b*x)^2,x]
```

output
```
(a*CosIntegral[d*(a/b + x)]*(a*d*Cos[c - (a*d)/b] - 2*b*Sin[c - (a*d)/b])
+ b*(-((b*Cos[c + d*x])/d) - (a^2*Sin[c + d*x])/(a + b*x)) - a*(2*b*Cos[c
- (a*d)/b] + a*d*Sin[c - (a*d)/b])*SinIntegral[d*(a/b + x)])/b^4
```

### 3.28.3 Rubi [A] (verified)

Time = 0.57 (sec) , antiderivative size = 149, normalized size of antiderivative = 1.00, number of steps used = 2, number of rules used = 2, $\frac{\text{number of rules}}{\text{integrand size}} = 0.118$, Rules used = {7293, 2009}

Below are the steps used by Rubi to obtain the solution. The rule number used for the transformation is given above next to the arrow. The rules definitions used are listed below.

$$\int \frac{x^2 \sin(c+dx)}{(a+bx)^2} \, dx$$

$$\Big\downarrow \text{ 7293}$$

$$\int \left(\frac{a^2 \sin(c+dx)}{b^2(a+bx)^2}-\frac{2a \sin(c+dx)}{b^2(a+bx)}+\frac{\sin(c+dx)}{b^2}\right) dx$$

$$\Big\downarrow \text{ 2009}$$

$$\frac{a^2 d \cos\left(c-\frac{ad}{b}\right) \text{CosIntegral}\left(xd+\frac{ad}{b}\right)}{b^4}-\frac{a^2 d \sin\left(c-\frac{ad}{b}\right) \text{Si}\left(xd+\frac{ad}{b}\right)}{b^4}-\frac{a^2 \sin(c+dx)}{b^3(a+bx)}-\frac{2a \sin\left(c-\frac{ad}{b}\right) \text{CosIntegral}\left(xd+\frac{ad}{b}\right)}{b^3}-\frac{2a \cos\left(c-\frac{ad}{b}\right) \text{Si}\left(xd+\frac{ad}{b}\right)}{b^3}-\frac{\cos(c+dx)}{b^2 d}$$

input
```
Int[(x^2*Sin[c + d*x])/(a + b*x)^2,x]
```

output
```
-(Cos[c + d*x]/(b^2*d)) + (a^2*d*Cos[c - (a*d)/b]*CosIntegral[(a*d)/b + d*
x])/b^4 - (2*a*CosIntegral[(a*d)/b + d*x]*Sin[c - (a*d)/b])/b^3 - (a^2*Sin
[c + d*x])/(b^3*(a + b*x)) - (2*a*Cos[c - (a*d)/b]*SinIntegral[(a*d)/b + d
*x])/b^3 - (a^2*d*Sin[c - (a*d)/b]*SinIntegral[(a*d)/b + d*x])/b^4
```

#### 3.28.3.1 Defintions of rubi rules used

rule 2009
```
Int[u_, x_Symbol] :> Simp[IntSum[u, x], x] /; SumQ[u]
```

rule 7293
```
Int[u_, x_Symbol] :> With[{v = ExpandIntegrand[u, x]}, Int[v, x] /; SumQ[v]
]
```

### 3.28.4 Maple [C] (verified)

Result contains complex when optimal does not.

Time = 0.31 (sec) , antiderivative size = 402, normalized size of antiderivative = 2.70

| method | result |
|---|---|
| risch | $-\frac{i\left(2 i b^{3} d^{2} x^{2}+4 i a\, b^{2} d^{2} x+2 i a^{2} b\, d^{2}\right) \cos \left(d x+c\right)}{2 b^{3} d^{2} \left(b x+a\right) \left(-d x b-d a\right)}+\frac{\left(2 a^{2} b\, d^{3} x+2 d^{3} a^{3}\right) \sin \left(d x+c\right)}{2 b^{3} d^{2} \left(b x+a\right) \left(-d x b-d a\right)}-\frac{i \cos \left(\frac{d a-c b}{b}\right) \operatorname{Ei}_{1}\left(-\frac{i d \left(b x+a\right)}{b}\right) a}{b^{3}}$ |
| derivativedivides | $\frac{c^{2} d^{2} \left(-\frac{\sin \left(d x+c\right)}{\left(d a-c b+b \left(d x+c\right)\right) b}+\frac{\frac{\operatorname{Si}\left(d x+c+\frac{d a-c b}{b}\right) \sin \left(\frac{d a-c b}{b}\right)}{b}+\frac{\operatorname{Ci}\left(d x+c+\frac{d a-c b}{b}\right) \cos \left(\frac{d a-c b}{b}\right)}{b}}{b}\right)-\frac{2 c\, d^{2} \left(\frac{\operatorname{Si}\left(d x+c+\frac{d a-c b}{b}\right) \cos}{b}\right.}{}}{}$ |
| default | $\frac{c^{2} d^{2} \left(-\frac{\sin \left(d x+c\right)}{\left(d a-c b+b \left(d x+c\right)\right) b}+\frac{\frac{\operatorname{Si}\left(d x+c+\frac{d a-c b}{b}\right) \sin \left(\frac{d a-c b}{b}\right)}{b}+\frac{\operatorname{Ci}\left(d x+c+\frac{d a-c b}{b}\right) \cos \left(\frac{d a-c b}{b}\right)}{b}}{b}\right)-\frac{2 c\, d^{2} \left(\frac{\operatorname{Si}\left(d x+c+\frac{d a-c b}{b}\right) \cos}{b}\right.}{}}{}$ |

input
```
int(x^2*sin(d*x+c)/(b*x+a)^2,x,method=_RETURNVERBOSE)
```

output
```
-1/2*I/b^3/d^2*(2*I*a^2*b*d^2+4*I*a*b^2*d^2*x+2*I*b^3*d^2*x^2)/(b*x+a)/(-b
*d*x-a*d)*cos(d*x+c)+1/2/b^3/d^2*(2*a^2*b*d^3*x+2*a^3*d^3)/(b*x+a)/(-b*d*x
-a*d)*sin(d*x+c)-I/b^3*cos((a*d-b*c)/b)*Ei(1,-I*d*(b*x+a)/b)*a+I/b^3*cos((
a*d-b*c)/b)*Ei(1,I*d*(b*x+a)/b)*a-1/2*d/b^4*cos((a*d-b*c)/b)*Ei(1,-I*d*(b*
x+a)/b)*a^2-1/2*d/b^4*cos((a*d-b*c)/b)*Ei(1,I*d*(b*x+a)/b)*a^2-1/b^3*sin((
a*d-b*c)/b)*Ei(1,-I*d*(b*x+a)/b)*a-1/b^3*sin((a*d-b*c)/b)*Ei(1,I*d*(b*x+a)
/b)*a+1/2*I*d/b^4*sin((a*d-b*c)/b)*Ei(1,-I*d*(b*x+a)/b)*a^2-1/2*I*d/b^4*si
n((a*d-b*c)/b)*Ei(1,I*d*(b*x+a)/b)*a^2
```

### 3.28.5 Fricas [A] (verification not implemented)

Time = 0.29 (sec) , antiderivative size = 202, normalized size of antiderivative = 1.36

$$\int \frac{x^2\sin(c+dx)}{(a+bx)^2}\,dx = -\frac{a^2bd\sin(dx+c)+(b^3x+ab^2)\cos(dx+c)-\left((a^2bd^2x+a^3d^2)\,\mathrm{Ci}\left(\frac{bdx+ad}{b}\right)-2\,(ab^2dx+a^2bd)\,\mathrm{Si}\left(\frac{bdx+a}{b}\right.\right.}{b^5dx+ab^4}$$

input
```
integrate(x^2*sin(d*x+c)/(b*x+a)^2,x, algorithm="fricas")
```

output
```
-(a^2*b*d*sin(d*x + c) + (b^3*x + a*b^2)*cos(d*x + c) - ((a^2*b*d^2*x + a^
3*d^2)*cos_integral((b*d*x + a*d)/b) - 2*(a*b^2*d*x + a^2*b*d)*sin_integra
l((b*d*x + a*d)/b))*cos(-(b*c - a*d)/b) - (2*(a*b^2*d*x + a^2*b*d)*cos_int
egral((b*d*x + a*d)/b) + (a^2*b*d^2*x + a^3*d^2)*sin_integral((b*d*x + a*d
)/b))*sin(-(b*c - a*d)/b))/(b^5*d*x + a*b^4*d)
```

### 3.28.6 Sympy [F]

$$\int \frac{x^2\sin(c+dx)}{(a+bx)^2}\,dx = \int \frac{x^2\sin{(c+dx)}}{(a+bx)^2}\,dx$$

input
```
integrate(x**2*sin(d*x+c)/(b*x+a)**2,x)
```

output
```
Integral(x**2*sin(c + d*x)/(a + b*x)**2, x)
```

### 3.28.7 Maxima [F]

$$\int \frac{x^2\sin(c+dx)}{(a+bx)^2}\,dx = \int \frac{x^2\sin{(dx+c)}}{(bx+a)^2}\,dx$$

input
```
integrate(x^2*sin(d*x+c)/(b*x+a)^2,x, algorithm="maxima")
```

output
```
-1/2*((cos(c)^2 + sin(c)^2)*x^2*cos(d*x + c) + (x^2*cos(d*x + c)^2*cos(c)
+ x^2*cos(c)*sin(d*x + c)^2)*cos(d*x + 2*c) - 2*(((a*b^2*cos(c)^2 + a*b^2*
sin(c)^2)*d*x^2 + 2*(a^2*b*cos(c)^2 + a^2*b*sin(c)^2)*d*x + (a^3*cos(c)^2
+ a^3*sin(c)^2)*d)*cos(d*x + c)^2 + ((a*b^2*cos(c)^2 + a*b^2*sin(c)^2)*d*x
^2 + 2*(a^2*b*cos(c)^2 + a^2*b*sin(c)^2)*d*x + (a^3*cos(c)^2 + a^3*sin(c)^
2)*d)*sin(d*x + c)^2)*integrate(x*cos(d*x + c)/(b^3*d*x^3 + 3*a*b^2*d*x^2
+ 3*a^2*b*d*x + a^3*d), x) - 2*(((a*b^2*cos(c)^2 + a*b^2*sin(c)^2)*d*x^2 +
 2*(a^2*b*cos(c)^2 + a^2*b*sin(c)^2)*d*x + (a^3*cos(c)^2 + a^3*sin(c)^2)*d
)*cos(d*x + c)^2 + ((a*b^2*cos(c)^2 + a*b^2*sin(c)^2)*d*x^2 + 2*(a^2*b*cos
(c)^2 + a^2*b*sin(c)^2)*d*x + (a^3*cos(c)^2 + a^3*sin(c)^2)*d)*sin(d*x + c
)^2)*integrate(x*cos(d*x + c)/((b^3*d*x^3 + 3*a*b^2*d*x^2 + 3*a^2*b*d*x +
a^3*d)*cos(d*x + c)^2 + (b^3*d*x^3 + 3*a*b^2*d*x^2 + 3*a^2*b*d*x + a^3*d)*
sin(d*x + c)^2), x) + (x^2*cos(d*x + c)^2*sin(c) + x^2*sin(d*x + c)^2*sin(
c))*sin(d*x + 2*c))/(((b^2*cos(c)^2 + b^2*sin(c)^2)*d*x^2 + 2*(a*b*cos(c)^
2 + a*b*sin(c)^2)*d*x + (a^2*cos(c)^2 + a^2*sin(c)^2)*d)*cos(d*x + c)^2 +
((b^2*cos(c)^2 + b^2*sin(c)^2)*d*x^2 + 2*(a*b*cos(c)^2 + a*b*sin(c)^2)*d*x
 + (a^2*cos(c)^2 + a^2*sin(c)^2)*d)*sin(d*x + c)^2)
```

### 3.28.8 Giac [B] (verification not implemented)

Leaf count of result is larger than twice the leaf count of optimal. 1120 vs. $2(152) = 304$.

Time = 0.33 (sec) , antiderivative size = 1120, normalized size of antiderivative = 7.52

$$\int \frac{x^2 \sin(c + dx)}{(a + bx)^2} \, dx = \text{Too large to display}$$

input
```
integrate(x^2*sin(d*x+c)/(b*x+a)^2,x, algorithm="giac")
```

output
```
((b*x + a)*a^2*(b*c/(b*x + a) - a*d/(b*x + a) + d)*d^2*cos(-(b*c - a*d)/b)
*cos_integral(((b*x + a)*(b*c/(b*x + a) - a*d/(b*x + a) + d) - b*c + a*d)/
b) - a^2*b*c*d^2*cos(-(b*c - a*d)/b)*cos_integral(((b*x + a)*(b*c/(b*x + a
) - a*d/(b*x + a) + d) - b*c + a*d)/b) + a^3*d^3*cos(-(b*c - a*d)/b)*cos_i
ntegral(((b*x + a)*(b*c/(b*x + a) - a*d/(b*x + a) + d) - b*c + a*d)/b) + (
b*x + a)*a^2*(b*c/(b*x + a) - a*d/(b*x + a) + d)*d^2*sin(-(b*c - a*d)/b)*s
in_integral(((b*x + a)*(b*c/(b*x + a) - a*d/(b*x + a) + d) - b*c + a*d)/b)
 - a^2*b*c*d^2*sin(-(b*c - a*d)/b)*sin_integral(((b*x + a)*(b*c/(b*x + a)
- a*d/(b*x + a) + d) - b*c + a*d)/b) + a^3*d^3*sin(-(b*c - a*d)/b)*sin_int
egral(((b*x + a)*(b*c/(b*x + a) - a*d/(b*x + a) + d) - b*c + a*d)/b) + 2*(
b*x + a)*a*b*(b*c/(b*x + a) - a*d/(b*x + a) + d)*d*cos_integral(((b*x + a)
*(b*c/(b*x + a) - a*d/(b*x + a) + d) - b*c + a*d)/b)*sin(-(b*c - a*d)/b) -
 2*a*b^2*c*d*cos_integral(((b*x + a)*(b*c/(b*x + a) - a*d/(b*x + a) + d) -
 b*c + a*d)/b)*sin(-(b*c - a*d)/b) + 2*a^2*b*d^2*cos_integral(((b*x + a)*(
b*c/(b*x + a) - a*d/(b*x + a) + d) - b*c + a*d)/b)*sin(-(b*c - a*d)/b) - 2
*(b*x + a)*a*b*(b*c/(b*x + a) - a*d/(b*x + a) + d)*d*cos(-(b*c - a*d)/b)*s
in_integral(((b*x + a)*(b*c/(b*x + a) - a*d/(b*x + a) + d) - b*c + a*d)/b)
 + 2*a*b^2*c*d*cos(-(b*c - a*d)/b)*sin_integral(((b*x + a)*(b*c/(b*x + a)
- a*d/(b*x + a) + d) - b*c + a*d)/b) - 2*a^2*b*d^2*cos(-(b*c - a*d)/b)*sin
_integral(((b*x + a)*(b*c/(b*x + a) - a*d/(b*x + a) + d) - b*c + a*d)/b...
```

## 3.28.9 Mupad [F(-1)]

Timed out.

$$\int \frac{x^2 \sin(c+dx)}{(a+bx)^2} \, dx = \int \frac{x^2 \sin(c+d\,x)}{(a+b\,x)^2} \, dx$$

input
```
int((x^2*sin(c + d*x))/(a + b*x)^2,x)
```

output
```
int((x^2*sin(c + d*x))/(a + b*x)^2, x)
```

# 3.29 $\int \frac{x\sin(c+dx)}{(a+bx)^2}\,dx$



## 3.29.1 Optimal result

Integrand size = 15, antiderivative size = 124

$$\int \frac{x\sin(c+dx)}{(a+bx)^2}\,dx = -\frac{ad\cos\left(c-\frac{ad}{b}\right)\text{CosIntegral}\left(\frac{ad}{b}+dx\right)}{b^3} + \frac{\text{CosIntegral}\left(\frac{ad}{b}+dx\right)\sin\left(c-\frac{ad}{b}\right)}{b^2} + \frac{a\sin(c+dx)}{b^2(a+bx)} + \frac{\cos\left(c-\frac{ad}{b}\right)\text{Si}\left(\frac{ad}{b}+dx\right)}{b^2} + \frac{ad\sin\left(c-\frac{ad}{b}\right)\text{Si}\left(\frac{ad}{b}+dx\right)}{b^3}$$

output
```
-a*d*Ci(a*d/b+d*x)*cos(-c+a*d/b)/b^3+cos(-c+a*d/b)*Si(a*d/b+d*x)/b^2-Ci(a*
d/b+d*x)*sin(-c+a*d/b)/b^2-a*d*Si(a*d/b+d*x)*sin(-c+a*d/b)/b^3+a*sin(d*x+c
)/b^2/(b*x+a)
```

## 3.29.2 Mathematica [A] (verified)

Time = 0.34 (sec) , antiderivative size = 96, normalized size of antiderivative = 0.77

$$\int \frac{x\sin(c+dx)}{(a+bx)^2}\,dx = \frac{\text{CosIntegral}\left(d\left(\frac{a}{b}+x\right)\right)\left(-ad\cos\left(c-\frac{ad}{b}\right)+b\sin\left(c-\frac{ad}{b}\right)\right)+\frac{ab\sin(c+dx)}{a+bx}+\left(b\cos\left(c-\frac{ad}{b}\right)+ad\sin\left(c-\frac{ad}{b}\right.\right.}{b^3}$$

input
```
Integrate[(x*Sin[c + d*x])/(a + b*x)^2,x]
```

output
```
(CosIntegral[d*(a/b + x)]*(-(a*d*Cos[c - (a*d)/b]) + b*Sin[c - (a*d)/b]) +
 (a*b*Sin[c + d*x])/(a + b*x) + (b*Cos[c - (a*d)/b] + a*d*Sin[c - (a*d)/b]
)*SinIntegral[d*(a/b + x)])/b^3
```

### 3.29.3 Rubi [A] (verified)

Time = 0.50 (sec) , antiderivative size = 124, normalized size of antiderivative = 1.00, number of steps used = 2, number of rules used = 2, $\frac{\text{number of rules}}{\text{integrand size}} = 0.133$, Rules used = {7293, 2009}

Below are the steps used by Rubi to obtain the solution. The rule number used for the transformation is given above next to the arrow. The rules definitions used are listed below.

$$\int \frac{x \sin(c+dx)}{(a+bx)^2} \, dx$$

$$\Big\downarrow \text{7293}$$

$$\int \left(\frac{\sin(c+dx)}{b(a+bx)} - \frac{a \sin(c+dx)}{b(a+bx)^2}\right) dx$$

$$\Big\downarrow \text{2009}$$

$$-\frac{ad \cos\left(c-\frac{ad}{b}\right) \text{CosIntegral}\left(xd+\frac{ad}{b}\right)}{b^3} + \frac{ad \sin\left(c-\frac{ad}{b}\right) \text{Si}\left(xd+\frac{ad}{b}\right)}{b^3} + \frac{\sin\left(c-\frac{ad}{b}\right) \text{CosIntegral}\left(xd+\frac{ad}{b}\right)}{b^2} + \frac{\cos\left(c-\frac{ad}{b}\right) \text{Si}\left(xd+\frac{ad}{b}\right)}{b^2} + \frac{a \sin(c+dx)}{b^2(a+bx)}$$

input
```
Int[(x*Sin[c + d*x])/(a + b*x)^2,x]
```

output
```
-((a*d*Cos[c - (a*d)/b]*CosIntegral[(a*d)/b + d*x])/b^3) + (CosIntegral[(a
*d)/b + d*x]*Sin[c - (a*d)/b])/b^2 + (a*Sin[c + d*x])/(b^2*(a + b*x)) + (C
os[c - (a*d)/b]*SinIntegral[(a*d)/b + d*x])/b^2 + (a*d*Sin[c - (a*d)/b]*Si
nIntegral[(a*d)/b + d*x])/b^3
```

#### 3.29.3.1 Defintions of rubi rules used

rule 2009
```
Int[u_, x_Symbol] :> Simp[IntSum[u, x], x] /; SumQ[u]
```

rule 7293
```
Int[u_, x_Symbol] :> With[{v = ExpandIntegrand[u, x]}, Int[v, x] /; SumQ[v]
]
```

## 3.29.4 Maple [C] (verified)

Result contains complex when optimal does not.

Time = 0.28 (sec) , antiderivative size = 313, normalized size of antiderivative = 2.52

| method | result |
|---|---|
| risch | $\frac{(-2abdx-2a^2d)\sin(dx+c)}{2b^2(bx+a)(-dxb-da)}+\frac{\cos\left(\frac{da-cb}{b}\right)\mathrm{Ei}_1\left(\frac{id(bx+a)}{b}\right)ad}{2b^3}+\frac{\cos\left(\frac{da-cb}{b}\right)\mathrm{Ei}_1\left(-\frac{id(bx+a)}{b}\right)ad}{2b^3}-\frac{i\cos\left(\frac{da-cb}{b}\right)\mathrm{E}\ldots}{2b^2\ldots}$ |
| derivativedivides | $\frac{-\frac{d^2(da-cb)\left(-\frac{\sin(dx+c)}{(da-cb+b(dx+c))b}+\frac{\frac{\mathrm{Si}\left(dx+c+\frac{da-cb}{b}\right)\sin\left(\frac{da-cb}{b}\right)}{b}+\frac{\mathrm{Ci}\left(dx+c+\frac{da-cb}{b}\right)\cos\left(\frac{da-cb}{b}\right)}{b}}{b}\right)}{b}+d^2\left(\frac{\mathrm{Si}\left(dx+c+\frac{da-cb}{b}\right)}{b}\ldots\right.}{\ldots}$ |
| default | $\frac{-\frac{d^2(da-cb)\left(-\frac{\sin(dx+c)}{(da-cb+b(dx+c))b}+\frac{\frac{\mathrm{Si}\left(dx+c+\frac{da-cb}{b}\right)\sin\left(\frac{da-cb}{b}\right)}{b}+\frac{\mathrm{Ci}\left(dx+c+\frac{da-cb}{b}\right)\cos\left(\frac{da-cb}{b}\right)}{b}}{b}\right)}{b}+d^2\left(\frac{\mathrm{Si}\left(dx+c+\frac{da-cb}{b}\right)}{b}\ldots\right.}{\ldots}$ |

input
```
int(x*sin(d*x+c)/(b*x+a)^2,x,method=_RETURNVERBOSE)
```

output
```
1/2/b^2*(-2*a*b*d*x-2*a^2*d)/(b*x+a)/(-b*d*x-a*d)*sin(d*x+c)+1/2/b^3*cos((
a*d-b*c)/b)*Ei(1,I*d*(b*x+a)/b)*a*d+1/2/b^3*cos((a*d-b*c)/b)*Ei(1,-I*d*(b*
x+a)/b)*a*d-1/2*I/b^2*cos((a*d-b*c)/b)*Ei(1,I*d*(b*x+a)/b)+1/2*I/b^2*cos((
a*d-b*c)/b)*Ei(1,-I*d*(b*x+a)/b)+1/2*I/b^3*sin((a*d-b*c)/b)*Ei(1,I*d*(b*x+
a)/b)*a*d-1/2*I/b^3*sin((a*d-b*c)/b)*Ei(1,-I*d*(b*x+a)/b)*a*d+1/2/b^2*sin(
(a*d-b*c)/b)*Ei(1,I*d*(b*x+a)/b)+1/2/b^2*sin((a*d-b*c)/b)*Ei(1,-I*d*(b*x+a
)/b)
```

### 3.29.5 Fricas [A] (verification not implemented)

Time = 0.28 (sec) , antiderivative size = 155, normalized size of antiderivative = 1.25

$$\int \frac{x\sin(c+dx)}{(a+bx)^2}\,dx = \frac{ab\sin(dx+c) - \left(\left(abdx+a^2d\right)\operatorname{Ci}\left(\frac{bdx+ad}{b}\right) - \left(b^2x+ab\right)\operatorname{Si}\left(\frac{bdx+ad}{b}\right)\right)\cos\left(-\frac{bc-ad}{b}\right) - \left(\left(b^2x+ab\right)\operatorname{Ci}\left(\frac{bdx+a}{b}\right.\right.}{b^4x+ab^3}$$

input
```
integrate(x*sin(d*x+c)/(b*x+a)^2,x, algorithm="fricas")
```

output
```
(a*b*sin(d*x + c) - ((a*b*d*x + a^2*d)*cos_integral((b*d*x + a*d)/b) - (b^
2*x + a*b)*sin_integral((b*d*x + a*d)/b))*cos(-(b*c - a*d)/b) - ((b^2*x +
a*b)*cos_integral((b*d*x + a*d)/b) + (a*b*d*x + a^2*d)*sin_integral((b*d*x
 + a*d)/b))*sin(-(b*c - a*d)/b))/(b^4*x + a*b^3)
```

### 3.29.6 Sympy [F]

$$\int \frac{x\sin(c+dx)}{(a+bx)^2}\,dx = \int \frac{x\sin(c+dx)}{(a+bx)^2}\,dx$$

input
```
integrate(x*sin(d*x+c)/(b*x+a)**2,x)
```

output
```
Integral(x*sin(c + d*x)/(a + b*x)**2, x)
```

### 3.29.7 Maxima [F]

$$\int \frac{x\sin(c+dx)}{(a+bx)^2}\,dx = \int \frac{x\sin(dx+c)}{(bx+a)^2}\,dx$$

input
```
integrate(x*sin(d*x+c)/(b*x+a)^2,x, algorithm="maxima")
```

output
```
-1/2*((b*cos(c)^2 + b*sin(c)^2)*x*cos(d*x + c) + ((a*(exp_integral_e(3, (I
*b*d*x + I*a*d)/b) + exp_integral_e(3, -(I*b*d*x + I*a*d)/b))*cos(c)^2 + a
*(exp_integral_e(3, (I*b*d*x + I*a*d)/b) + exp_integral_e(3, -(I*b*d*x + I
*a*d)/b))*sin(c)^2)*cos(-(b*c - a*d)/b) + (a*(I*exp_integral_e(3, (I*b*d*x
 + I*a*d)/b) - I*exp_integral_e(3, -(I*b*d*x + I*a*d)/b))*cos(c)^2 + a*(I*
exp_integral_e(3, (I*b*d*x + I*a*d)/b) - I*exp_integral_e(3, -(I*b*d*x + I
*a*d)/b))*sin(c)^2)*sin(-(b*c - a*d)/b))*cos(d*x + c)^2 + ((a*(exp_integra
l_e(3, (I*b*d*x + I*a*d)/b) + exp_integral_e(3, -(I*b*d*x + I*a*d)/b))*cos
(c)^2 + a*(exp_integral_e(3, (I*b*d*x + I*a*d)/b) + exp_integral_e(3, -(I*
b*d*x + I*a*d)/b))*sin(c)^2)*cos(-(b*c - a*d)/b) + (a*(I*exp_integral_e(3,
 (I*b*d*x + I*a*d)/b) - I*exp_integral_e(3, -(I*b*d*x + I*a*d)/b))*cos(c)^
2 + a*(I*exp_integral_e(3, (I*b*d*x + I*a*d)/b) - I*exp_integral_e(3, -(I*
b*d*x + I*a*d)/b))*sin(c)^2)*sin(-(b*c - a*d)/b))*sin(d*x + c)^2 + (b*x*co
s(d*x + c)^2*cos(c) + b*x*cos(c)*sin(d*x + c)^2)*cos(d*x + 2*c) + 2*(((b^4
*cos(c)^2 + b^4*sin(c)^2)*d*x^2 + 2*(a*b^3*cos(c)^2 + a*b^3*sin(c)^2)*d*x
+ (a^2*b^2*cos(c)^2 + a^2*b^2*sin(c)^2)*d)*cos(d*x + c)^2 + ((b^4*cos(c)^2
 + b^4*sin(c)^2)*d*x^2 + 2*(a*b^3*cos(c)^2 + a*b^3*sin(c)^2)*d*x + (a^2*b^
2*cos(c)^2 + a^2*b^2*sin(c)^2)*d)*sin(d*x + c)^2)*integrate(1/2*x*cos(d*x
+ c)/(b^3*d*x^3 + 3*a*b^2*d*x^2 + 3*a^2*b*d*x + a^3*d), x) + 2*(((b^4*cos(
c)^2 + b^4*sin(c)^2)*d*x^2 + 2*(a*b^3*cos(c)^2 + a*b^3*sin(c)^2)*d*x + ...
```

### 3.29.8 Giac [B] (verification not implemented)

Leaf count of result is larger than twice the leaf count of optimal. 951 vs. $2(130) = 260$.

Time = 0.35 (sec) , antiderivative size = 951, normalized size of antiderivative = 7.67

$$\int \frac{x\sin(c+dx)}{(a+bx)^2}\,dx =$$

$$-\frac{\left((bx+a)a\left(\frac{bc}{bx+a}-\frac{ad}{bx+a}+d\right)d^2\cos\left(-\frac{bc-ad}{b}\right)\operatorname{Ci}\left(\frac{(bx+a)\left(\frac{bc}{bx+a}-\frac{ad}{bx+a}+d\right)-bc+ad}{b}\right)-abcd^2\cos\left(-\frac{bc-ad}{b}\right)\operatorname{Ci}\left(\right.\right.}{}$$

input
```
integrate(x*sin(d*x+c)/(b*x+a)^2,x, algorithm="giac")
```

output
```
-((b*x + a)*a*(b*c/(b*x + a) - a*d/(b*x + a) + d)*d^2*cos(-(b*c - a*d)/b)*
cos_integral(((b*x + a)*(b*c/(b*x + a) - a*d/(b*x + a) + d) - b*c + a*d)/b
) - a*b*c*d^2*cos(-(b*c - a*d)/b)*cos_integral(((b*x + a)*(b*c/(b*x + a) -
 a*d/(b*x + a) + d) - b*c + a*d)/b) + a^2*d^3*cos(-(b*c - a*d)/b)*cos_inte
gral(((b*x + a)*(b*c/(b*x + a) - a*d/(b*x + a) + d) - b*c + a*d)/b) + (b*x
 + a)*a*(b*c/(b*x + a) - a*d/(b*x + a) + d)*d^2*sin(-(b*c - a*d)/b)*sin_in
tegral(((b*x + a)*(b*c/(b*x + a) - a*d/(b*x + a) + d) - b*c + a*d)/b) - a*
b*c*d^2*sin(-(b*c - a*d)/b)*sin_integral(((b*x + a)*(b*c/(b*x + a) - a*d/(
b*x + a) + d) - b*c + a*d)/b) + a^2*d^3*sin(-(b*c - a*d)/b)*sin_integral((
(b*x + a)*(b*c/(b*x + a) - a*d/(b*x + a) + d) - b*c + a*d)/b) + (b*x + a)*
b*(b*c/(b*x + a) - a*d/(b*x + a) + d)*d*cos_integral(((b*x + a)*(b*c/(b*x
+ a) - a*d/(b*x + a) + d) - b*c + a*d)/b)*sin(-(b*c - a*d)/b) - b^2*c*d*co
s_integral(((b*x + a)*(b*c/(b*x + a) - a*d/(b*x + a) + d) - b*c + a*d)/b)*
sin(-(b*c - a*d)/b) + a*b*d^2*cos_integral(((b*x + a)*(b*c/(b*x + a) - a*d
/(b*x + a) + d) - b*c + a*d)/b)*sin(-(b*c - a*d)/b) - (b*x + a)*b*(b*c/(b*
x + a) - a*d/(b*x + a) + d)*d*cos(-(b*c - a*d)/b)*sin_integral(((b*x + a)*
(b*c/(b*x + a) - a*d/(b*x + a) + d) - b*c + a*d)/b) + b^2*c*d*cos(-(b*c -
a*d)/b)*sin_integral(((b*x + a)*(b*c/(b*x + a) - a*d/(b*x + a) + d) - b*c
+ a*d)/b) - a*b*d^2*cos(-(b*c - a*d)/b)*sin_integral(((b*x + a)*(b*c/(b*x
+ a) - a*d/(b*x + a) + d) - b*c + a*d)/b) + a*b*d^2*sin(-(b*x + a)*(b*c...
```

### 3.29.9 Mupad [F(-1)]

Timed out.

$$\int \frac{x\sin(c+dx)}{(a+bx)^2}\,dx = \int \frac{x\,\sin\left(c+d\,x\right)}{\left(a+b\,x\right)^2}\,dx$$

input
```
int((x*sin(c + d*x))/(a + b*x)^2,x)
```

output
```
int((x*sin(c + d*x))/(a + b*x)^2, x)
```

# 3.30 $\int \frac{\sin(c+dx)}{(a+bx)^2}\,dx$



## 3.30.1 Optimal result

Integrand size = 14, antiderivative size = 72

$$\int \frac{\sin(c+dx)}{(a+bx)^2}\,dx = \frac{d\cos\left(c-\frac{ad}{b}\right)\text{CosIntegral}\left(\frac{ad}{b}+dx\right)}{b^2} - \frac{\sin(c+dx)}{b(a+bx)} - \frac{d\sin\left(c-\frac{ad}{b}\right)\text{Si}\left(\frac{ad}{b}+dx\right)}{b^2}$$

output
```
d*Ci(a*d/b+d*x)*cos(-c+a*d/b)/b^2+d*Si(a*d/b+d*x)*sin(-c+a*d/b)/b^2-sin(d*
x+c)/b/(b*x+a)
```

## 3.30.2 Mathematica [A] (verified)

Time = 0.17 (sec) , antiderivative size = 66, normalized size of antiderivative = 0.92

$$\int \frac{\sin(c+dx)}{(a+bx)^2}\,dx = \frac{d\cos\left(c-\frac{ad}{b}\right)\text{CosIntegral}\left(d\left(\frac{a}{b}+x\right)\right)-\frac{b\sin(c+dx)}{a+bx}-d\sin\left(c-\frac{ad}{b}\right)\text{Si}\left(d\left(\frac{a}{b}+x\right)\right)}{b^2}$$

input
```
Integrate[Sin[c + d*x]/(a + b*x)^2,x]
```

output
```
(d*Cos[c - (a*d)/b]*CosIntegral[d*(a/b + x)] - (b*Sin[c + d*x])/(a + b*x)
- d*Sin[c - (a*d)/b]*SinIntegral[d*(a/b + x)])/b^2
```

### 3.30.3 Rubi [A] (verified)

Time = 0.49 (sec) , antiderivative size = 76, normalized size of antiderivative = 1.06, number of steps used = 7, number of rules used = 7, $\frac{\text{number of rules}}{\text{integrand size}}$ = 0.500, Rules used = {3042, 3778, 3042, 3784, 3042, 3780, 3783}

Below are the steps used by Rubi to obtain the solution. The rule number used for the transformation is given above next to the arrow. The rules definitions used are listed below.

$$\int \frac{\sin(c+dx)}{(a+bx)^2} \, dx$$

$$\Big\downarrow \text{3042}$$

$$\int \frac{\sin(c+dx)}{(a+bx)^2}dx$$

$$\Big\downarrow \text{3778}$$

$$\frac{d\int \frac{\cos(c+dx)}{a+bx}dx}{b}-\frac{\sin(c+dx)}{b(a+bx)}$$

$$\Big\downarrow \text{3042}$$

$$\frac{d\int \frac{\sin\left(c+dx+\frac{\pi}{2}\right)}{a+bx}dx}{b}-\frac{\sin(c+dx)}{b(a+bx)}$$

$$\Big\downarrow \text{3784}$$

$$\frac{d\left(\cos\left(c-\frac{ad}{b}\right)\int \frac{\cos\left(xd+\frac{ad}{b}\right)}{a+bx}dx-\sin\left(c-\frac{ad}{b}\right)\int \frac{\sin\left(xd+\frac{ad}{b}\right)}{a+bx}dx\right)}{b}-\frac{\sin(c+dx)}{b(a+bx)}$$

$$\Big\downarrow \text{3042}$$

$$\frac{d\left(\cos\left(c-\frac{ad}{b}\right)\int \frac{\sin\left(xd+\frac{ad}{b}+\frac{\pi}{2}\right)}{a+bx}dx-\sin\left(c-\frac{ad}{b}\right)\int \frac{\sin\left(xd+\frac{ad}{b}\right)}{a+bx}dx\right)}{b}-\frac{\sin(c+dx)}{b(a+bx)}$$

$$\Big\downarrow \text{3780}$$

$$\frac{d\left(\cos\left(c-\frac{ad}{b}\right)\int \frac{\sin\left(xd+\frac{ad}{b}+\frac{\pi}{2}\right)}{a+bx}dx-\frac{\sin\left(c-\frac{ad}{b}\right)\text{Si}\left(xd+\frac{ad}{b}\right)}{b}\right)}{b}-\frac{\sin(c+dx)}{b(a+bx)}$$

$$\Big\downarrow \text{3783}$$

$$\frac{d\left(\frac{\cos\left(c-\frac{ad}{b}\right)\text{CosIntegral}\left(xd+\frac{ad}{b}\right)}{b}-\frac{\sin\left(c-\frac{ad}{b}\right)\text{Si}\left(xd+\frac{ad}{b}\right)}{b}\right)}{b}-\frac{\sin(c+dx)}{b(a+bx)}$$

input
```
Int[Sin[c + d*x]/(a + b*x)^2,x]
```

output
```
-(Sin[c + d*x]/(b*(a + b*x))) + (d*((Cos[c - (a*d)/b]*CosIntegral[(a*d)/b
+ d*x])/b - (Sin[c - (a*d)/b]*SinIntegral[(a*d)/b + d*x])/b))/b
```

### 3.30.3.1 Defintions of rubi rules used

rule 3042
```
Int[u_, x_Symbol] :> Int[DeactivateTrig[u, x], x] /; FunctionOfTrigOfLinear
Q[u, x]
```

rule 3778
```
Int[((c_.) + (d_.)*(x_))^(m_)*sin[(e_.) + (f_.)*(x_)], x_Symbol] :> Simp[(c
 + d*x)^(m + 1)*(Sin[e + f*x]/(d*(m + 1))), x] - Simp[f/(d*(m + 1))   Int[(
c + d*x)^(m + 1)*Cos[e + f*x], x], x] /; FreeQ[{c, d, e, f}, x] && LtQ[m, -
1]
```

rule 3780
```
Int[sin[(e_.) + (f_.)*(x_)]/((c_.) + (d_.)*(x_)), x_Symbol] :> Simp[SinInte
gral[e + f*x]/d, x] /; FreeQ[{c, d, e, f}, x] && EqQ[d*e - c*f, 0]
```

rule 3783
```
Int[sin[(e_.) + (f_.)*(x_)]/((c_.) + (d_.)*(x_)), x_Symbol] :> Simp[CosInte
gral[e - Pi/2 + f*x]/d, x] /; FreeQ[{c, d, e, f}, x] && EqQ[d*(e - Pi/2) -
c*f, 0]
```

rule 3784
```
Int[sin[(e_.) + (f_.)*(x_)]/((c_.) + (d_.)*(x_)), x_Symbol] :> Simp[Cos[(d*
e - c*f)/d]   Int[Sin[c*(f/d) + f*x]/(c + d*x), x], x] + Simp[Sin[(d*e - c*
f)/d]   Int[Cos[c*(f/d) + f*x]/(c + d*x), x], x] /; FreeQ[{c, d, e, f}, x]
&& NeQ[d*e - c*f, 0]
```

### 3.30.4 Maple [A] (verified)

Time = 0.25 (sec) , antiderivative size = 107, normalized size of antiderivative = 1.49

| method | result | size |
|---|---|---|
| derivativedivides | $d\left(-\frac{\sin(dx+c)}{(da-cb+b(dx+c))b}+\frac{\frac{\mathrm{Si}\left(dx+c+\frac{da-cb}{b}\right)\sin\left(\frac{da-cb}{b}\right)}{b}+\frac{\mathrm{Ci}\left(dx+c+\frac{da-cb}{b}\right)\cos\left(\frac{da-cb}{b}\right)}{b}}{b}\right)$ | 107 |
| default | $d\left(-\frac{\sin(dx+c)}{(da-cb+b(dx+c))b}+\frac{\frac{\mathrm{Si}\left(dx+c+\frac{da-cb}{b}\right)\sin\left(\frac{da-cb}{b}\right)}{b}+\frac{\mathrm{Ci}\left(dx+c+\frac{da-cb}{b}\right)\cos\left(\frac{da-cb}{b}\right)}{b}}{b}\right)$ | 107 |
| risch | $-\frac{d\,\mathrm{e}^{-\frac{i(da-cb)}{b}}\mathrm{Ei}_1\left(-idx-ic-\frac{iad-icb}{b}\right)}{2b^2}-\frac{d\,\mathrm{e}^{\frac{i(da-cb)}{b}}\mathrm{Ei}_1\left(idx+ic+\frac{i(da-cb)}{b}\right)}{2b^2}-\frac{(-2dxb-2da)\sin(dx+c)}{2b(bx+a)(-dxb-da)}$ | 138 |

input
```
int(sin(d*x+c)/(b*x+a)^2,x,method=_RETURNVERBOSE)
```

output
```
d*(-sin(d*x+c)/(d*a-c*b+b*(d*x+c))/b+(Si(d*x+c+(a*d-b*c)/b)*sin((a*d-b*c)/
b)/b+Ci(d*x+c+(a*d-b*c)/b)*cos((a*d-b*c)/b)/b)/b)
```

### 3.30.5 Fricas [A] (verification not implemented)

Time = 0.28 (sec) , antiderivative size = 96, normalized size of antiderivative = 1.33

$$\int \frac{\sin(c+dx)}{(a+bx)^2}\,dx = \frac{(bdx+ad)\cos\left(-\frac{bc-ad}{b}\right)\mathrm{Ci}\left(\frac{bdx+ad}{b}\right)+(bdx+ad)\sin\left(-\frac{bc-ad}{b}\right)\mathrm{Si}\left(\frac{bdx+ad}{b}\right)-b\sin\left(dx+c\right)}{b^3x+ab^2}$$

input
```
integrate(sin(d*x+c)/(b*x+a)^2,x, algorithm="fricas")
```

output
```
((b*d*x + a*d)*cos(-(b*c - a*d)/b)*cos_integral((b*d*x + a*d)/b) + (b*d*x
+ a*d)*sin(-(b*c - a*d)/b)*sin_integral((b*d*x + a*d)/b) - b*sin(d*x + c))
/(b^3*x + a*b^2)
```

### 3.30.6 Sympy [F]

$$\int \frac{\sin(c+dx)}{(a+bx)^2}\,dx = \int \frac{\sin\left(c+dx\right)}{\left(a+bx\right)^2}\,dx$$

input
```
integrate(sin(d*x+c)/(b*x+a)**2,x)
```

output
```
Integral(sin(c + d*x)/(a + b*x)**2, x)
```

### 3.30.7 Maxima [C] (verification not implemented)

Result contains complex when optimal does not.

Time = 0.24 (sec) , antiderivative size = 164, normalized size of antiderivative = 2.28

$$\int \frac{\sin(c+dx)}{(a+bx)^2}\,dx = \frac{d^2\left(-i\,E_2\left(\frac{i\,(dx+c)b-i\,bc+i\,ad}{b}\right)+i\,E_2\left(-\frac{i\,(dx+c)b-i\,bc+i\,ad}{b}\right)\right)\cos\left(-\frac{bc-ad}{b}\right)+d^2\left(E_2\left(\frac{i\,(dx+c)b-i\,bc+i\,ad}{b}\right)+E_2\left(-\frac{i\,\ldots}{}\right.\right.}{2\left((dx+c)b^2-b^2c+abd\right)d}$$

input
```
integrate(sin(d*x+c)/(b*x+a)^2,x, algorithm="maxima")
```

output
```
1/2*(d^2*(-I*exp_integral_e(2, (I*(d*x + c)*b - I*b*c + I*a*d)/b) + I*exp_
integral_e(2, -(I*(d*x + c)*b - I*b*c + I*a*d)/b))*cos(-(b*c - a*d)/b) + d
^2*(exp_integral_e(2, (I*(d*x + c)*b - I*b*c + I*a*d)/b) + exp_integral_e(
2, -(I*(d*x + c)*b - I*b*c + I*a*d)/b))*sin(-(b*c - a*d)/b))/(((d*x + c)*b
^2 - b^2*c + a*b*d)*d)
```

### 3.30.8 Giac [B] (verification not implemented)

Leaf count of result is larger than twice the leaf count of optimal. 518 vs. 2(73) = 146.

Time = 0.30 (sec) , antiderivative size = 518, normalized size of antiderivative = 7.19

$$\int \frac{\sin(c+dx)}{(a+bx)^2}\,dx = \frac{\left((bx+a)\left(\frac{bc}{bx+a}-\frac{ad}{bx+a}+d\right)d^2\cos\left(-\frac{bc-ad}{b}\right)\operatorname{Ci}\left(\frac{(bx+a)\left(\frac{bc}{bx+a}-\frac{ad}{bx+a}+d\right)-bc+ad}{b}\right)-bcd^2\cos\left(-\frac{bc-ad}{b}\right)\operatorname{Ci}\left(\frac{(bx+a\ldots}{}\right.\right.}{}$$

input
```
integrate(sin(d*x+c)/(b*x+a)^2,x, algorithm="giac")
```

output
```
((b*x + a)*(b*c/(b*x + a) - a*d/(b*x + a) + d)*d^2*cos(-(b*c - a*d)/b)*cos
_integral(((b*x + a)*(b*c/(b*x + a) - a*d/(b*x + a) + d) - b*c + a*d)/b) -
 b*c*d^2*cos(-(b*c - a*d)/b)*cos_integral(((b*x + a)*(b*c/(b*x + a) - a*d/
(b*x + a) + d) - b*c + a*d)/b) + a*d^3*cos(-(b*c - a*d)/b)*cos_integral(((
b*x + a)*(b*c/(b*x + a) - a*d/(b*x + a) + d) - b*c + a*d)/b) + (b*x + a)*(
b*c/(b*x + a) - a*d/(b*x + a) + d)*d^2*sin(-(b*c - a*d)/b)*sin_integral(((
b*x + a)*(b*c/(b*x + a) - a*d/(b*x + a) + d) - b*c + a*d)/b) - b*c*d^2*sin
(-(b*c - a*d)/b)*sin_integral(((b*x + a)*(b*c/(b*x + a) - a*d/(b*x + a) +
d) - b*c + a*d)/b) + a*d^3*sin(-(b*c - a*d)/b)*sin_integral(((b*x + a)*(b*
c/(b*x + a) - a*d/(b*x + a) + d) - b*c + a*d)/b) + b*d^2*sin(-(b*x + a)*(b
*c/(b*x + a) - a*d/(b*x + a) + d)/b))*b^2/(((b*x + a)*b^4*(b*c/(b*x + a) -
 a*d/(b*x + a) + d) - b^5*c + a*b^4*d)*d)
```

### 3.30.9 Mupad [F(-1)]

Timed out.

$$\int \frac{\sin(c+dx)}{(a+bx)^2}\,dx = \int \frac{\sin\left(c+d\,x\right)}{{\left(a+b\,x\right)}^2}\,dx$$

input
```
int(sin(c + d*x)/(a + b*x)^2,x)
```

output
```
int(sin(c + d*x)/(a + b*x)^2, x)
```

# 3.31 $\int \frac{\sin(c+dx)}{x(a+bx)^2}\,dx$



## 3.31.1 Optimal result

Integrand size = 17, antiderivative size = 149

$$\int \frac{\sin(c+dx)}{x(a+bx)^2}\,dx = -\frac{d\cos\left(c-\frac{ad}{b}\right)\operatorname{CosIntegral}\left(\frac{ad}{b}+dx\right)}{ab}+\frac{\operatorname{CosIntegral}(dx)\sin(c)}{a^2} - \frac{\operatorname{CosIntegral}\left(\frac{ad}{b}+dx\right)\sin\left(c-\frac{ad}{b}\right)}{a^2}+\frac{\sin(c+dx)}{a(a+bx)}+\frac{\cos(c)\operatorname{Si}(dx)}{a^2} - \frac{\cos\left(c-\frac{ad}{b}\right)\operatorname{Si}\left(\frac{ad}{b}+dx\right)}{a^2}+\frac{d\sin\left(c-\frac{ad}{b}\right)\operatorname{Si}\left(\frac{ad}{b}+dx\right)}{ab}$$

output
```
-d*Ci(a*d/b+d*x)*cos(-c+a*d/b)/a/b+cos(c)*Si(d*x)/a^2-cos(-c+a*d/b)*Si(a*d
/b+d*x)/a^2+Ci(d*x)*sin(c)/a^2+Ci(a*d/b+d*x)*sin(-c+a*d/b)/a^2-d*Si(a*d/b+
d*x)*sin(-c+a*d/b)/a/b+sin(d*x+c)/a/(b*x+a)
```

## 3.31.2 Mathematica [A] (verified)

Time = 0.70 (sec) , antiderivative size = 138, normalized size of antiderivative = 0.93

$$\int \frac{\sin(c+dx)}{x(a+bx)^2}\,dx = \frac{\frac{a\cos(dx)\sin(c)}{a+bx}+\operatorname{CosIntegral}(dx)\sin(c)-\frac{\operatorname{CosIntegral}\left(d\left(\frac{a}{b}+x\right)\right)\left(ad\cos\left(c-\frac{ad}{b}\right)+b\sin\left(c-\frac{ad}{b}\right)\right)}{b}+\frac{a\cos(c)\sin(dx)}{a+bx}+\cos(c)\operatorname{Si}}{a^2}$$

input
```
Integrate[Sin[c + d*x]/(x*(a + b*x)^2),x]
```

output
```
((a*Cos[d*x]*Sin[c])/(a + b*x) + CosIntegral[d*x]*Sin[c] - (CosIntegral[d*
(a/b + x)]*(a*d*Cos[c - (a*d)/b] + b*Sin[c - (a*d)/b]))/b + (a*Cos[c]*Sin[
d*x])/(a + b*x) + Cos[c]*SinIntegral[d*x] - Cos[c - (a*d)/b]*SinIntegral[d
*(a/b + x)] + (a*d*Sin[c - (a*d)/b]*SinIntegral[d*(a/b + x)])/b)/a^2
```

### 3.31.3 Rubi [A] (verified)

Time = 0.57 (sec) , antiderivative size = 149, normalized size of antiderivative = 1.00, number of steps used = 2, number of rules used = 2, $\frac{\text{number of rules}}{\text{integrand size}} = 0.118$, Rules used = {7293, 2009}

Below are the steps used by Rubi to obtain the solution. The rule number used for the transformation is given above next to the arrow. The rules definitions used are listed below.

$$\int \frac{\sin(c+dx)}{x(a+bx)^2} dx$$

$$\Big\downarrow \text{7293}$$

$$\int \left(-\frac{b\sin(c+dx)}{a^2(a+bx)}+\frac{\sin(c+dx)}{a^2x}-\frac{b\sin(c+dx)}{a(a+bx)^2}\right)dx$$

$$\Big\downarrow \text{2009}$$

$$-\frac{\sin\left(c-\frac{ad}{b}\right)\text{CosIntegral}\left(xd+\frac{ad}{b}\right)}{a^2}-\frac{\cos\left(c-\frac{ad}{b}\right)\text{Si}\left(xd+\frac{ad}{b}\right)}{a^2}+\frac{\sin(c)\text{CosIntegral}(dx)}{a^2}+\frac{\cos(c)\text{Si}(dx)}{a^2}-\frac{d\cos\left(c-\frac{ad}{b}\right)\text{CosIntegral}\left(xd+\frac{ad}{b}\right)}{ab}+\frac{d\sin\left(c-\frac{ad}{b}\right)\text{Si}\left(xd+\frac{ad}{b}\right)}{ab}+\frac{\sin(c+dx)}{a(a+bx)}$$

input
```
Int[Sin[c + d*x]/(x*(a + b*x)^2),x]
```

output
```
-((d*Cos[c - (a*d)/b]*CosIntegral[(a*d)/b + d*x])/(a*b)) + (CosIntegral[d*
x]*Sin[c])/a^2 - (CosIntegral[(a*d)/b + d*x]*Sin[c - (a*d)/b])/a^2 + Sin[c
 + d*x]/(a*(a + b*x)) + (Cos[c]*SinIntegral[d*x])/a^2 - (Cos[c - (a*d)/b]*
SinIntegral[(a*d)/b + d*x])/a^2 + (d*Sin[c - (a*d)/b]*SinIntegral[(a*d)/b
+ d*x])/(a*b)
```

#### 3.31.3.1 Defintions of rubi rules used

rule 2009
```
Int[u_, x_Symbol] :> Simp[IntSum[u, x], x] /; SumQ[u]
```

rule 7293
```
Int[u_, x_Symbol] :> With[{v = ExpandIntegrand[u, x]}, Int[v, x] /; SumQ[v]
]
```

### 3.31.4 Maple [A] (verified)

Time = 0.28 (sec) , antiderivative size = 210, normalized size of antiderivative = 1.41

| method | result |
|---|---|
| derivativedivides | $-\frac{b\left(\frac{\mathrm{Si}\left(dx+c+\frac{da-cb}{b}\right)\cos\left(\frac{da-cb}{b}\right)}{b}-\frac{\mathrm{Ci}\left(dx+c+\frac{da-cb}{b}\right)\sin\left(\frac{da-cb}{b}\right)}{b}\right)}{a^2}-\frac{db\left(-\frac{\sin(dx+c)}{(da-cb+b(dx+c))b}+\frac{\mathrm{Si}\left(dx+c+\frac{da-cb}{b}\right)\sin\left(\right.}{b}\right.}{a}$ |
| default | $-\frac{b\left(\frac{\mathrm{Si}\left(dx+c+\frac{da-cb}{b}\right)\cos\left(\frac{da-cb}{b}\right)}{b}-\frac{\mathrm{Ci}\left(dx+c+\frac{da-cb}{b}\right)\sin\left(\frac{da-cb}{b}\right)}{b}\right)}{a^2}-\frac{db\left(-\frac{\sin(dx+c)}{(da-cb+b(dx+c))b}+\frac{\mathrm{Si}\left(dx+c+\frac{da-cb}{b}\right)\sin\left(\right.}{b}\right.}{a}$ |
| risch | $\frac{ie^{ic}\,\mathrm{Ei}_1(-idx)}{2a^2}-\frac{ie^{-\frac{i(da-cb)}{b}}\,\mathrm{Ei}_1\left(-idx-ic-\frac{iad-icb}{b}\right)}{2a^2}+\frac{d\,e^{-\frac{i(da-cb)}{b}}\,\mathrm{Ei}_1\left(-idx-ic-\frac{iad-icb}{b}\right)}{2ab}-\frac{e^{-ic}\pi\,\mathrm{csgn}(dx}{2a^2}$ |

input
```
int(sin(d*x+c)/x/(b*x+a)^2,x,method=_RETURNVERBOSE)
```

output
```
-b/a^2*(Si(d*x+c+(a*d-b*c)/b)*cos((a*d-b*c)/b)/b-Ci(d*x+c+(a*d-b*c)/b)*sin
((a*d-b*c)/b)/b)-d*b/a*(-sin(d*x+c)/(d*a-c*b+b*(d*x+c))/b+(Si(d*x+c+(a*d-b
*c)/b)*sin((a*d-b*c)/b)/b+Ci(d*x+c+(a*d-b*c)/b)*cos((a*d-b*c)/b)/b)/b)+1/a
^2*(Si(d*x)*cos(c)+Ci(d*x)*sin(c))
```

### 3.31.5 Fricas [A] (verification not implemented)

Time = 0.29 (sec) , antiderivative size = 189, normalized size of antiderivative = 1.27

$$\int \frac{\sin(c+dx)}{x(a+bx)^2}\,dx$$
$$= \frac{ab\sin(dx+c)+(b^2x+ab)\,\mathrm{Ci}(dx)\sin(c)+(b^2x+ab)\cos(c)\,\mathrm{Si}(dx)-\left((abdx+a^2d)\,\mathrm{Ci}\left(\frac{bdx+ad}{b}\right)+(b^2x\right.}{a^2b^2x+a}$$

input
```
integrate(sin(d*x+c)/x/(b*x+a)^2,x, algorithm="fricas")
```

output
```
(a*b*sin(d*x + c) + (b^2*x + a*b)*cos_integral(d*x)*sin(c) + (b^2*x + a*b)
*cos(c)*sin_integral(d*x) - ((a*b*d*x + a^2*d)*cos_integral((b*d*x + a*d)/
b) + (b^2*x + a*b)*sin_integral((b*d*x + a*d)/b))*cos(-(b*c - a*d)/b) + ((
b^2*x + a*b)*cos_integral((b*d*x + a*d)/b) - (a*b*d*x + a^2*d)*sin_integra
l((b*d*x + a*d)/b))*sin(-(b*c - a*d)/b))/(a^2*b^2*x + a^3*b)
```

### 3.31.6 Sympy [F]

$$\int \frac{\sin(c+dx)}{x(a+bx)^2}\,dx = \int \frac{\sin{(c+dx)}}{x\,(a+bx)^2}\,dx$$

input
```
integrate(sin(d*x+c)/x/(b*x+a)**2,x)
```

output
```
Integral(sin(c + d*x)/(x*(a + b*x)**2), x)
```

### 3.31.7 Maxima [F]

$$\int \frac{\sin(c+dx)}{x(a+bx)^2}\,dx = \int \frac{\sin{(dx+c)}}{(bx+a)^2 x}\,dx$$

input
```
integrate(sin(d*x+c)/x/(b*x+a)^2,x, algorithm="maxima")
```

output
```
integrate(sin(d*x + c)/((b*x + a)^2*x), x)
```

### 3.31.8 Giac [B] (verification not implemented)

Leaf count of result is larger than twice the leaf count of optimal. 1281 vs. $2(153) = 306$.

Time = 0.34 (sec) , antiderivative size = 1281, normalized size of antiderivative = 8.60

$$\int \frac{\sin(c+dx)}{x(a+bx)^2}\,dx = \text{Too large to display}$$

input
```
integrate(sin(d*x+c)/x/(b*x+a)^2,x, algorithm="giac")
```

output
```
-((b*x + a)*a*(b*c/(b*x + a) - a*d/(b*x + a) + d)*d^2*cos(-(b*c - a*d)/b)*
cos_integral(((b*x + a)*(b*c/(b*x + a) - a*d/(b*x + a) + d) - b*c + a*d)/b
) - a*b*c*d^2*cos(-(b*c - a*d)/b)*cos_integral(((b*x + a)*(b*c/(b*x + a) -
 a*d/(b*x + a) + d) - b*c + a*d)/b) + a^2*d^3*cos(-(b*c - a*d)/b)*cos_inte
gral(((b*x + a)*(b*c/(b*x + a) - a*d/(b*x + a) + d) - b*c + a*d)/b) + (b*x
 + a)*a*(b*c/(b*x + a) - a*d/(b*x + a) + d)*d^2*sin(-(b*c - a*d)/b)*sin_in
tegral(((b*x + a)*(b*c/(b*x + a) - a*d/(b*x + a) + d) - b*c + a*d)/b) - a*
b*c*d^2*sin(-(b*c - a*d)/b)*sin_integral(((b*x + a)*(b*c/(b*x + a) - a*d/(
b*x + a) + d) - b*c + a*d)/b) + a^2*d^3*sin(-(b*c - a*d)/b)*sin_integral((
(b*x + a)*(b*c/(b*x + a) - a*d/(b*x + a) + d) - b*c + a*d)/b) - (b*x + a)*
b*(b*c/(b*x + a) - a*d/(b*x + a) + d)*d*cos_integral((b*x + a)*(b*c/(b*x +
 a) - a*d/(b*x + a) + d)/b - c)*sin(c) + b^2*c*d*cos_integral((b*x + a)*(b
*c/(b*x + a) - a*d/(b*x + a) + d)/b - c)*sin(c) - a*b*d^2*cos_integral((b*
x + a)*(b*c/(b*x + a) - a*d/(b*x + a) + d)/b - c)*sin(c) - (b*x + a)*b*(b*
c/(b*x + a) - a*d/(b*x + a) + d)*d*cos_integral(((b*x + a)*(b*c/(b*x + a)
- a*d/(b*x + a) + d) - b*c + a*d)/b)*sin(-(b*c - a*d)/b) + b^2*c*d*cos_int
egral(((b*x + a)*(b*c/(b*x + a) - a*d/(b*x + a) + d) - b*c + a*d)/b)*sin(-
(b*c - a*d)/b) - a*b*d^2*cos_integral(((b*x + a)*(b*c/(b*x + a) - a*d/(b*x
 + a) + d) - b*c + a*d)/b)*sin(-(b*c - a*d)/b) + (b*x + a)*b*(b*c/(b*x + a
) - a*d/(b*x + a) + d)*d*cos(c)*sin_integral(-(b*x + a)*(b*c/(b*x + a) ...
```

### 3.31.9 Mupad [F(-1)]

Timed out.

$$\int \frac{\sin(c+dx)}{x(a+bx)^2}\,dx = \int \frac{\sin(c+d\,x)}{x\,(a+b\,x)^2}\,dx$$

input
```
int(sin(c + d*x)/(x*(a + b*x)^2),x)
```

output
```
int(sin(c + d*x)/(x*(a + b*x)^2), x)
```

# 3.32 $\int \frac{\sin(c+dx)}{x^2(a+bx)^2}\,dx$



## 3.32.1 Optimal result

Integrand size = 17, antiderivative size = 188

$$\begin{aligned}\int \frac{\sin(c+dx)}{x^2(a+bx)^2}\,dx &= \frac{d\cos(c)\,\text{CosIntegral}(dx)}{a^2}+\frac{d\cos\left(c-\frac{ad}{b}\right)\text{CosIntegral}\left(\frac{ad}{b}+dx\right)}{a^2}\\ &\quad-\frac{2b\,\text{CosIntegral}(dx)\sin(c)}{a^3}+\frac{2b\,\text{CosIntegral}\left(\frac{ad}{b}+dx\right)\sin\left(c-\frac{ad}{b}\right)}{a^3}\\ &\quad-\frac{\sin(c+dx)}{a^2x}-\frac{b\sin(c+dx)}{a^2(a+bx)}-\frac{2b\cos(c)\text{Si}(dx)}{a^3}-\frac{d\sin(c)\text{Si}(dx)}{a^2}\\ &\quad+\frac{2b\cos\left(c-\frac{ad}{b}\right)\text{Si}\left(\frac{ad}{b}+dx\right)}{a^3}-\frac{d\sin\left(c-\frac{ad}{b}\right)\text{Si}\left(\frac{ad}{b}+dx\right)}{a^2}\end{aligned}$$

output
```
d*Ci(d*x)*cos(c)/a^2+d*Ci(a*d/b+d*x)*cos(-c+a*d/b)/a^2-2*b*cos(c)*Si(d*x)/
a^3+2*b*cos(-c+a*d/b)*Si(a*d/b+d*x)/a^3-2*b*Ci(d*x)*sin(c)/a^3-d*Si(d*x)*s
in(c)/a^2-2*b*Ci(a*d/b+d*x)*sin(-c+a*d/b)/a^3+d*Si(a*d/b+d*x)*sin(-c+a*d/b
)/a^2-sin(d*x+c)/a^2/x-b*sin(d*x+c)/a^2/(b*x+a)
```

### 3.32.2 Mathematica [A] (verified)

Time = 1.25 (sec) , antiderivative size = 184, normalized size of antiderivative = 0.98

$$\int \frac{\sin(c+dx)}{x^2(a+bx)^2}\,dx =$$
$$-\frac{-ad\cos(c)\,\text{CosIntegral}(dx)-ad\cos\left(c-\frac{ad}{b}\right)\text{CosIntegral}\left(d\left(\frac{a}{b}+x\right)\right)+\frac{a(a+2bx)\cos(dx)\sin(c)}{x(a+bx)}+2b\,\text{CosInte}}{}$$

input
```
Integrate[Sin[c + d*x]/(x^2*(a + b*x)^2),x]
```

output
```
-((-(a*d*Cos[c]*CosIntegral[d*x]) - a*d*Cos[c - (a*d)/b]*CosIntegral[d*(a/
b + x)] + (a*(a + 2*b*x)*Cos[d*x]*Sin[c])/(x*(a + b*x)) + 2*b*CosIntegral[
d*x]*Sin[c] - 2*b*CosIntegral[d*(a/b + x)]*Sin[c - (a*d)/b] + (a*(a + 2*b*
x)*Cos[c]*Sin[d*x])/(x*(a + b*x)) + 2*b*Cos[c]*SinIntegral[d*x] + a*d*Sin[
c]*SinIntegral[d*x] - 2*b*Cos[c - (a*d)/b]*SinIntegral[d*(a/b + x)] + a*d*
Sin[c - (a*d)/b]*SinIntegral[d*(a/b + x)])/a^3)
```

### 3.32.3 Rubi [A] (verified)

Time = 0.70 (sec) , antiderivative size = 188, normalized size of antiderivative = 1.00, number of steps used = 2, number of rules used = 2, $\frac{\text{number of rules}}{\text{integrand size}} = 0.118$, Rules used = {7293, 2009}

Below are the steps used by Rubi to obtain the solution. The rule number used for the transformation is given above next to the arrow. The rules definitions used are listed below.

$$\int \frac{\sin(c+dx)}{x^2(a+bx)^2}\,dx$$
$$\Big\downarrow \; 7293$$
$$\int \left(\frac{2b^2\sin(c+dx)}{a^3(a+bx)}-\frac{2b\sin(c+dx)}{a^3x}+\frac{b^2\sin(c+dx)}{a^2(a+bx)^2}+\frac{\sin(c+dx)}{a^2x^2}\right)dx$$
$$\Big\downarrow \; 2009$$
$$-\frac{2b\sin(c)\,\text{CosIntegral}(dx)}{a^3}+\frac{2b\sin\left(c-\frac{ad}{b}\right)\text{CosIntegral}\left(xd+\frac{ad}{b}\right)}{a^3}-\frac{2b\cos(c)\text{Si}(dx)}{a^3}+\frac{2b\cos\left(c-\frac{ad}{b}\right)\text{Si}\left(xd+\frac{ad}{b}\right)}{a^3}+\frac{d\cos\left(c-\frac{ad}{b}\right)\text{CosIntegral}\left(xd+\frac{ad}{b}\right)}{a^2}-\frac{d\sin\left(c-\frac{ad}{b}\right)\text{Si}\left(xd+\frac{ad}{b}\right)}{a^2}-\frac{b\sin(c+dx)}{a^2(a+bx)}+\frac{d\cos(c)\,\text{CosIntegral}(dx)}{a^2}-\frac{d\sin(c)\text{Si}(dx)}{a^2}-\frac{\sin(c+dx)}{a^2x}$$

input
```
Int[Sin[c + d*x]/(x^2*(a + b*x)^2),x]
```

output
```
(d*Cos[c]*CosIntegral[d*x])/a^2 + (d*Cos[c - (a*d)/b]*CosIntegral[(a*d)/b
+ d*x])/a^2 - (2*b*CosIntegral[d*x]*Sin[c])/a^3 + (2*b*CosIntegral[(a*d)/b
 + d*x]*Sin[c - (a*d)/b])/a^3 - Sin[c + d*x]/(a^2*x) - (b*Sin[c + d*x])/(a
^2*(a + b*x)) - (2*b*Cos[c]*SinIntegral[d*x])/a^3 - (d*Sin[c]*SinIntegral[
d*x])/a^2 + (2*b*Cos[c - (a*d)/b]*SinIntegral[(a*d)/b + d*x])/a^3 - (d*Sin
[c - (a*d)/b]*SinIntegral[(a*d)/b + d*x])/a^2
```

### 3.32.3.1 Defintions of rubi rules used

rule 2009
```
Int[u_, x_Symbol] :> Simp[IntSum[u, x], x] /; SumQ[u]
```

rule 7293
```
Int[u_, x_Symbol] :> With[{v = ExpandIntegrand[u, x]}, Int[v, x] /; SumQ[v]
]
```

## 3.32.4 Maple [A] (verified)

Time = 0.34 (sec) , antiderivative size = 256, normalized size of antiderivative = 1.36

| method | result |
|---|---|
| derivativedivides | $d\left(\frac{-\frac{\sin(dx+c)}{dx}-\mathrm{Si}(dx)\sin(c)+\mathrm{Ci}(dx)\cos(c)}{a^2}+\frac{b^2\left(-\frac{\sin(dx+c)}{(da-cb+b(dx+c))b}+\frac{\mathrm{Si}\left(dx+c+\frac{da-cb}{b}\right)\sin\left(\frac{da-cb}{b}\right)}{b}+\frac{\mathrm{Ci}\left(dx+c+\frac{da-}{b}\right.}{b}\right.}{a^2}\right.$ |
| default | $d\left(\frac{-\frac{\sin(dx+c)}{dx}-\mathrm{Si}(dx)\sin(c)+\mathrm{Ci}(dx)\cos(c)}{a^2}+\frac{b^2\left(-\frac{\sin(dx+c)}{(da-cb+b(dx+c))b}+\frac{\mathrm{Si}\left(dx+c+\frac{da-cb}{b}\right)\sin\left(\frac{da-cb}{b}\right)}{b}+\frac{\mathrm{Ci}\left(dx+c+\frac{da-}{b}\right.}{b}\right.}{a^2}\right.$ |
| risch | $-\frac{ib\,e^{ic}\,\mathrm{Ei}_1(-idx)}{a^3}+\frac{ib\,e^{-\frac{i(da-cb)}{b}}\,\mathrm{Ei}_1\left(-idx-ic-\frac{iad-icb}{b}\right)}{a^3}-\frac{d\,e^{ic}\,\mathrm{Ei}_1(-idx)}{2a^2}-\frac{d\,e^{-\frac{i(da-cb)}{b}}\,\mathrm{Ei}_1\left(-idx-ic-\frac{iad\right.}{2a^2}$ |

input
```
int(sin(d*x+c)/x^2/(b*x+a)^2,x,method=_RETURNVERBOSE)
```

output
```
d*(1/a^2*(-sin(d*x+c)/d/x-Si(d*x)*sin(c)+Ci(d*x)*cos(c))+b^2/a^2*(-sin(d*x
+c)/(d*a-c*b+b*(d*x+c))/b+(Si(d*x+c+(a*d-b*c)/b)*sin((a*d-b*c)/b)/b+Ci(d*x
+c+(a*d-b*c)/b)*cos((a*d-b*c)/b)/b)/b)-2/d/a^3*b*(Si(d*x)*cos(c)+Ci(d*x)*s
in(c))+2/d*b^2/a^3*(Si(d*x+c+(a*d-b*c)/b)*cos((a*d-b*c)/b)/b-Ci(d*x+c+(a*d
-b*c)/b)*sin((a*d-b*c)/b)/b))
```

### 3.32.5 Fricas [A] (verification not implemented)

Time = 0.31 (sec) , antiderivative size = 262, normalized size of antiderivative = 1.39

$$\int \frac{\sin(c+dx)}{x^2(a+bx)^2}\,dx$$
$$= \frac{\left(\left(abdx^2+a^2dx\right)\text{Ci}\left(dx\right)-2\left(b^2x^2+abx\right)\text{Si}\left(dx\right)\right)\cos\left(c\right)+\left(\left(abdx^2+a^2dx\right)\text{Ci}\left(\frac{bdx+ad}{b}\right)+2\left(b^2x^2+abx\right)\text{S}\right.}{}$$

input
```
integrate(sin(d*x+c)/x^2/(b*x+a)^2,x, algorithm="fricas")
```

output
```
(((a*b*d*x^2 + a^2*d*x)*cos_integral(d*x) - 2*(b^2*x^2 + a*b*x)*sin_integr
al(d*x))*cos(c) + ((a*b*d*x^2 + a^2*d*x)*cos_integral((b*d*x + a*d)/b) + 2
*(b^2*x^2 + a*b*x)*sin_integral((b*d*x + a*d)/b))*cos(-(b*c - a*d)/b) - (2
*a*b*x + a^2)*sin(d*x + c) - (2*(b^2*x^2 + a*b*x)*cos_integral(d*x) + (a*b
*d*x^2 + a^2*d*x)*sin_integral(d*x))*sin(c) - (2*(b^2*x^2 + a*b*x)*cos_int
egral((b*d*x + a*d)/b) - (a*b*d*x^2 + a^2*d*x)*sin_integral((b*d*x + a*d)/
b))*sin(-(b*c - a*d)/b))/(a^3*b*x^2 + a^4*x)
```

### 3.32.6 Sympy [F]

$$\int \frac{\sin(c+dx)}{x^2(a+bx)^2}\,dx = \int \frac{\sin\left(c+dx\right)}{x^2\left(a+bx\right)^2}\,dx$$

input
```
integrate(sin(d*x+c)/x**2/(b*x+a)**2,x)
```

output
```
Integral(sin(c + d*x)/(x**2*(a + b*x)**2), x)
```

### 3.32.7 Maxima [F]

$$\int \frac{\sin(c+dx)}{x^2(a+bx)^2}\,dx = \int \frac{\sin(dx+c)}{(bx+a)^2 x^2}\,dx$$

input
```
integrate(sin(d*x+c)/x^2/(b*x+a)^2,x, algorithm="maxima")
```

output
```
integrate(sin(d*x + c)/((b*x + a)^2*x^2), x)
```

### 3.32.8 Giac [B] (verification not implemented)

Leaf count of result is larger than twice the leaf count of optimal. 3180 vs. 2(191) = 382.

Time = 0.38 (sec) , antiderivative size = 3180, normalized size of antiderivative = 16.91

$$\int \frac{\sin(c+dx)}{x^2(a+bx)^2}\,dx = \text{Too large to display}$$

input
```
integrate(sin(d*x+c)/x^2/(b*x+a)^2,x, algorithm="giac")
```

output
```
((b*x + a)^2*a*(b*c/(b*x + a) - a*d/(b*x + a) + d)^2*d^2*cos(c)*cos_integr
al((b*x + a)*(b*c/(b*x + a) - a*d/(b*x + a) + d)/b - c)/b - 2*(b*x + a)*a*
(b*c/(b*x + a) - a*d/(b*x + a) + d)*c*d^2*cos(c)*cos_integral((b*x + a)*(b
*c/(b*x + a) - a*d/(b*x + a) + d)/b - c) + a*b*c^2*d^2*cos(c)*cos_integral
((b*x + a)*(b*c/(b*x + a) - a*d/(b*x + a) + d)/b - c) + (b*x + a)*a^2*(b*c
/(b*x + a) - a*d/(b*x + a) + d)*d^3*cos(c)*cos_integral((b*x + a)*(b*c/(b*
x + a) - a*d/(b*x + a) + d)/b - c)/b - a^2*c*d^3*cos(c)*cos_integral((b*x
+ a)*(b*c/(b*x + a) - a*d/(b*x + a) + d)/b - c) + (b*x + a)^2*a*(b*c/(b*x
+ a) - a*d/(b*x + a) + d)^2*d^2*cos(-(b*c - a*d)/b)*cos_integral(((b*x + a
)*(b*c/(b*x + a) - a*d/(b*x + a) + d) - b*c + a*d)/b)/b - 2*(b*x + a)*a*(b
*c/(b*x + a) - a*d/(b*x + a) + d)*c*d^2*cos(-(b*c - a*d)/b)*cos_integral((
(b*x + a)*(b*c/(b*x + a) - a*d/(b*x + a) + d) - b*c + a*d)/b) + a*b*c^2*d^
2*cos(-(b*c - a*d)/b)*cos_integral(((b*x + a)*(b*c/(b*x + a) - a*d/(b*x +
a) + d) - b*c + a*d)/b) + (b*x + a)*a^2*(b*c/(b*x + a) - a*d/(b*x + a) + d
)*d^3*cos(-(b*c - a*d)/b)*cos_integral(((b*x + a)*(b*c/(b*x + a) - a*d/(b*
x + a) + d) - b*c + a*d)/b)/b - a^2*c*d^3*cos(-(b*c - a*d)/b)*cos_integral
(((b*x + a)*(b*c/(b*x + a) - a*d/(b*x + a) + d) - b*c + a*d)/b) + (b*x + a
)^2*a*(b*c/(b*x + a) - a*d/(b*x + a) + d)^2*d^2*sin(c)*sin_integral(-(b*x
+ a)*(b*c/(b*x + a) - a*d/(b*x + a) + d)/b + c)/b - 2*(b*x + a)*a*(b*c/(b*
x + a) - a*d/(b*x + a) + d)*c*d^2*sin(c)*sin_integral(-(b*x + a)*(b*c/(...
```

### 3.32.9 Mupad [F(-1)]

Timed out.

$$\int \frac{\sin(c+dx)}{x^2(a+bx)^2} \, dx = \int \frac{\sin\left(c+d\,x\right)}{x^2\,{\left(a+b\,x\right)}^2} \,dx$$

input
```
int(sin(c + d*x)/(x^2*(a + b*x)^2),x)
```

output
```
int(sin(c + d*x)/(x^2*(a + b*x)^2), x)
```

# 3.33 $\int \frac{x^3 \sin(c+dx)}{(a+bx)^3} dx$



## 3.33.1 Optimal result

Integrand size = 17, antiderivative size = 265

$$\begin{aligned}\int \frac{x^3 \sin(c+dx)}{(a+bx)^3} dx = &-\frac{\cos(c+dx)}{b^3 d} + \frac{a^3 d \cos(c+dx)}{2b^5(a+bx)} \\ &+ \frac{3a^2 d \cos\left(c-\frac{ad}{b}\right) \text{CosIntegral}\left(\frac{ad}{b}+dx\right)}{b^5} \\ &- \frac{3a \,\text{CosIntegral}\left(\frac{ad}{b}+dx\right) \sin\left(c-\frac{ad}{b}\right)}{b^4} \\ &+ \frac{a^3 d^2 \,\text{CosIntegral}\left(\frac{ad}{b}+dx\right) \sin\left(c-\frac{ad}{b}\right)}{2b^6} + \frac{a^3 \sin(c+dx)}{2b^4(a+bx)^2} \\ &- \frac{3a^2 \sin(c+dx)}{b^4(a+bx)} - \frac{3a \cos\left(c-\frac{ad}{b}\right) \text{Si}\left(\frac{ad}{b}+dx\right)}{b^4} \\ &+ \frac{a^3 d^2 \cos\left(c-\frac{ad}{b}\right) \text{Si}\left(\frac{ad}{b}+dx\right)}{2b^6} - \frac{3a^2 d \sin\left(c-\frac{ad}{b}\right) \text{Si}\left(\frac{ad}{b}+dx\right)}{b^5}\end{aligned}$$

output
```
3*a^2*d*Ci(a*d/b+d*x)*cos(-c+a*d/b)/b^5-cos(d*x+c)/b^3/d+1/2*a^3*d*cos(d*x
+c)/b^5/(b*x+a)-3*a*cos(-c+a*d/b)*Si(a*d/b+d*x)/b^4+1/2*a^3*d^2*cos(-c+a*d
/b)*Si(a*d/b+d*x)/b^6+3*a*Ci(a*d/b+d*x)*sin(-c+a*d/b)/b^4-1/2*a^3*d^2*Ci(a
*d/b+d*x)*sin(-c+a*d/b)/b^6+3*a^2*d*Si(a*d/b+d*x)*sin(-c+a*d/b)/b^5+1/2*a^
3*sin(d*x+c)/b^4/(b*x+a)^2-3*a^2*sin(d*x+c)/b^4/(b*x+a)
```

### 3.33.2 Mathematica [A] (verified)

Time = 0.64 (sec) , antiderivative size = 235, normalized size of antiderivative = 0.89

$$\int \frac{x^3\sin(c+dx)}{(a+bx)^3}\,dx = -\frac{b\cos(dx)\left(-((a+bx)\left(-2ab^2+a^3d^2-2b^3x\right)\cos(c))+a^2bd(5a+6bx)\sin(c)\right)+b(a^2bd(5a+6bx)\cos(c}{}$$

input
```
Integrate[(x^3*Sin[c + d*x])/(a + b*x)^3,x]
```

output
```
-1/2*(b*Cos[d*x]*(-((a + b*x)*(-2*a*b^2 + a^3*d^2 - 2*b^3*x)*Cos[c]) + a^2
*b*d*(5*a + 6*b*x)*Sin[c]) + b*(a^2*b*d*(5*a + 6*b*x)*Cos[c] + (a + b*x)*(
-2*a*b^2 + a^3*d^2 - 2*b^3*x)*Sin[c])*Sin[d*x] - a*d*(a + b*x)^2*(CosInteg
ral[d*(a/b + x)]*(6*a*b*d*Cos[c - (a*d)/b] + (-6*b^2 + a^2*d^2)*Sin[c - (a
*d)/b]) + ((-6*b^2 + a^2*d^2)*Cos[c - (a*d)/b] - 6*a*b*d*Sin[c - (a*d)/b])
*SinIntegral[d*(a/b + x)]))/(b^6*d*(a + b*x)^2)
```

### 3.33.3 Rubi [A] (verified)

Time = 0.81 (sec) , antiderivative size = 265, normalized size of antiderivative = 1.00, number of steps used = 2, number of rules used = 2, $\frac{\text{number of rules}}{\text{integrand size}} = 0.118$, Rules used = {7293, 2009}

Below are the steps used by Rubi to obtain the solution. The rule number used for the transformation is given above next to the arrow. The rules definitions used are listed below.

$$\int \frac{x^3\sin(c+dx)}{(a+bx)^3}dx$$
$$\Big\downarrow \ 7293$$
$$\int \left(-\frac{a^3\sin(c+dx)}{b^3(a+bx)^3}+\frac{3a^2\sin(c+dx)}{b^3(a+bx)^2}-\frac{3a\sin(c+dx)}{b^3(a+bx)}+\frac{\sin(c+dx)}{b^3}\right)dx$$
$$\Big\downarrow \ 2009$$
$$\frac{a^3d^2\sin\left(c-\frac{ad}{b}\right)\text{CosIntegral}\left(xd+\frac{ad}{b}\right)}{2b^6}+\frac{a^3d^2\cos\left(c-\frac{ad}{b}\right)\text{Si}\left(xd+\frac{ad}{b}\right)}{2b^6}+\frac{a^3d\cos(c+dx)}{2b^5(a+bx)}+\frac{a^3\sin(c+dx)}{2b^4(a+bx)^2}+\frac{3a^2d\cos\left(c-\frac{ad}{b}\right)\text{CosIntegral}\left(xd+\frac{ad}{b}\right)}{b^5}-\frac{3a^2d\sin\left(c-\frac{ad}{b}\right)\text{Si}\left(xd+\frac{ad}{b}\right)}{b^5}-\frac{3a^2\sin(c+dx)}{b^4(a+bx)}-\frac{3a\sin\left(c-\frac{ad}{b}\right)\text{CosIntegral}\left(xd+\frac{ad}{b}\right)}{b^4}-\frac{3a\cos\left(c-\frac{ad}{b}\right)\text{Si}\left(xd+\frac{ad}{b}\right)}{b^4}-\frac{\cos(c+dx)}{b^3d}$$

input
```
Int[(x^3*Sin[c + d*x])/(a + b*x)^3,x]
```

output
```
-(Cos[c + d*x]/(b^3*d)) + (a^3*d*Cos[c + d*x])/(2*b^5*(a + b*x)) + (3*a^2*
d*Cos[c - (a*d)/b]*CosIntegral[(a*d)/b + d*x])/b^5 - (3*a*CosIntegral[(a*d
)/b + d*x]*Sin[c - (a*d)/b])/b^4 + (a^3*d^2*CosIntegral[(a*d)/b + d*x]*Sin
[c - (a*d)/b])/(2*b^6) + (a^3*Sin[c + d*x])/(2*b^4*(a + b*x)^2) - (3*a^2*S
in[c + d*x])/(b^4*(a + b*x)) - (3*a*Cos[c - (a*d)/b]*SinIntegral[(a*d)/b +
 d*x])/b^4 + (a^3*d^2*Cos[c - (a*d)/b]*SinIntegral[(a*d)/b + d*x])/(2*b^6)
 - (3*a^2*d*Sin[c - (a*d)/b]*SinIntegral[(a*d)/b + d*x])/b^5
```

#### 3.33.3.1 Defintions of rubi rules used

rule 2009
```
Int[u_, x_Symbol] :> Simp[IntSum[u, x], x] /; SumQ[u]
```

rule 7293
```
Int[u_, x_Symbol] :> With[{v = ExpandIntegrand[u, x]}, Int[v, x] /; SumQ[v]
]
```

## 3.33.4 Maple [C] (verified)

Result contains complex when optimal does not.

Time = 0.48 (sec) , antiderivative size = 705, normalized size of antiderivative = 2.66

| method | result |
|---|---|
| risch | $\frac{i\left(2ia^3b^3d^6x^3+6ia^4b^2d^6x^2-4ib^6d^4x^4+6ia^5b\,d^6x-16ia\,b^5d^4x^3+2ia^6d^6-24ia^2b^4d^4x^2-16ia^3b^3d^4x-4ia^4b^2d^4\right)\cos(dx+}{4b^5d^3(bx+a)^2\left(-d^2x^2b^2-2ab\,d^2x-d^2a^2\right)}$ |
| derivativedivides | Expression too large to display |
| default | Expression too large to display |

input
```
int(x^3*sin(d*x+c)/(b*x+a)^3,x,method=_RETURNVERBOSE)
```

output
```
1/4*I/b^5/d^3*(2*I*a^3*b^3*d^6*x^3+6*I*a^4*b^2*d^6*x^2+6*I*a^5*b*d^6*x-16*
I*a*b^5*d^4*x^3-4*I*b^6*d^4*x^4-4*I*a^4*b^2*d^4-24*I*a^2*b^4*d^4*x^2-16*I*
a^3*b^3*d^4*x+2*I*a^6*d^6)/(b*x+a)^2/(-b^2*d^2*x^2-2*a*b*d^2*x-a^2*d^2)*co
s(d*x+c)+1/4/b^5/d^3*(12*a^2*b^4*d^5*x^3+34*a^3*b^3*d^5*x^2+32*a^4*b^2*d^5
*x+10*a^5*b*d^5)/(b*x+a)^2/(-b^2*d^2*x^2-2*a*b*d^2*x-a^2*d^2)*sin(d*x+c)-3
/2*d/b^5*cos((a*d-b*c)/b)*Ei(1,-I*d*(b*x+a)/b)*a^2+1/4*I*d^2/b^6*cos((a*d-
b*c)/b)*Ei(1,-I*d*(b*x+a)/b)*a^3-3/2*d/b^5*cos((a*d-b*c)/b)*Ei(1,I*d*(b*x+
a)/b)*a^2-1/4*I*d^2/b^6*cos((a*d-b*c)/b)*Ei(1,I*d*(b*x+a)/b)*a^3-3/2*I/b^4
*cos((a*d-b*c)/b)*Ei(1,-I*d*(b*x+a)/b)*a+3/2*I/b^4*cos((a*d-b*c)/b)*Ei(1,I
*d*(b*x+a)/b)*a+3/2*I*d/b^5*sin((a*d-b*c)/b)*Ei(1,-I*d*(b*x+a)/b)*a^2+1/4*
d^2/b^6*sin((a*d-b*c)/b)*Ei(1,-I*d*(b*x+a)/b)*a^3-3/2*I*d/b^5*sin((a*d-b*c
)/b)*Ei(1,I*d*(b*x+a)/b)*a^2+1/4*d^2/b^6*sin((a*d-b*c)/b)*Ei(1,I*d*(b*x+a)
/b)*a^3-3/2/b^4*sin((a*d-b*c)/b)*Ei(1,-I*d*(b*x+a)/b)*a-3/2/b^4*sin((a*d-b
*c)/b)*Ei(1,I*d*(b*x+a)/b)*a
```

### 3.33.5 Fricas [A] (verification not implemented)

Time = 0.33 (sec) , antiderivative size = 388, normalized size of antiderivative = 1.46

$$\int \frac{x^3\sin(c+dx)}{(a+bx)^3}\,dx$$
$$= \frac{(a^4bd^2-2\,b^5x^2-2\,a^2b^3+(a^3b^2d^2-4\,ab^4)x)\cos{(dx+c)}+\left(6\,(a^2b^3d^2x^2+2\,a^3b^2d^2x+a^4bd^2)\operatorname{Ci}\left(\frac{bdx+ad}{b}\right)\right.}{}$$

input
```
integrate(x^3*sin(d*x+c)/(b*x+a)^3,x, algorithm="fricas")
```

output
```
1/2*((a^4*b*d^2 - 2*b^5*x^2 - 2*a^2*b^3 + (a^3*b^2*d^2 - 4*a*b^4)*x)*cos(d
*x + c) + (6*(a^2*b^3*d^2*x^2 + 2*a^3*b^2*d^2*x + a^4*b*d^2)*cos_integral(
(b*d*x + a*d)/b) + (a^5*d^3 - 6*a^3*b^2*d + (a^3*b^2*d^3 - 6*a*b^4*d)*x^2
+ 2*(a^4*b*d^3 - 6*a^2*b^3*d)*x)*sin_integral((b*d*x + a*d)/b))*cos(-(b*c
- a*d)/b) - (6*a^2*b^3*d*x + 5*a^3*b^2*d)*sin(d*x + c) - ((a^5*d^3 - 6*a^3
*b^2*d + (a^3*b^2*d^3 - 6*a*b^4*d)*x^2 + 2*(a^4*b*d^3 - 6*a^2*b^3*d)*x)*co
s_integral((b*d*x + a*d)/b) - 6*(a^2*b^3*d^2*x^2 + 2*a^3*b^2*d^2*x + a^4*b
*d^2)*sin_integral((b*d*x + a*d)/b))*sin(-(b*c - a*d)/b))/(b^8*d*x^2 + 2*a
*b^7*d*x + a^2*b^6*d)
```

### 3.33.6 Sympy [F]

$$\int \frac{x^3 \sin(c+dx)}{(a+bx)^3} dx = \int \frac{x^3 \sin{(c+dx)}}{(a+bx)^3} dx$$

input
```
integrate(x**3*sin(d*x+c)/(b*x+a)**3,x)
```

output
```
Integral(x**3*sin(c + d*x)/(a + b*x)**3, x)
```

### 3.33.7 Maxima [F]

$$\int \frac{x^3 \sin(c+dx)}{(a+bx)^3} dx = \int \frac{x^3 \sin{(dx+c)}}{(bx+a)^3} dx$$

input
```
integrate(x^3*sin(d*x+c)/(b*x+a)^3,x, algorithm="maxima")
```

output
```
-1/2*((b^2*cos(c)^2 + b^2*sin(c)^2)*d*x^3*cos(d*x + c) + 3*((a^2*(-I*exp_i
ntegral_e(4, (I*b*d*x + I*a*d)/b) + I*exp_integral_e(4, -(I*b*d*x + I*a*d)
/b))*cos(c)^2 + a^2*(-I*exp_integral_e(4, (I*b*d*x + I*a*d)/b) + I*exp_int
egral_e(4, -(I*b*d*x + I*a*d)/b))*sin(c)^2)*cos(-(b*c - a*d)/b) + (a^2*(ex
p_integral_e(4, (I*b*d*x + I*a*d)/b) + exp_integral_e(4, -(I*b*d*x + I*a*d
)/b))*cos(c)^2 + a^2*(exp_integral_e(4, (I*b*d*x + I*a*d)/b) + exp_integra
l_e(4, -(I*b*d*x + I*a*d)/b))*sin(c)^2)*sin(-(b*c - a*d)/b))*cos(d*x + c)^
2 - 3*(a*b*cos(c)^2 + a*b*sin(c)^2)*x*sin(d*x + c) + 3*((a^2*(-I*exp_integ
ral_e(4, (I*b*d*x + I*a*d)/b) + I*exp_integral_e(4, -(I*b*d*x + I*a*d)/b))
*cos(c)^2 + a^2*(-I*exp_integral_e(4, (I*b*d*x + I*a*d)/b) + I*exp_integra
l_e(4, -(I*b*d*x + I*a*d)/b))*sin(c)^2)*cos(-(b*c - a*d)/b) + (a^2*(exp_in
tegral_e(4, (I*b*d*x + I*a*d)/b) + exp_integral_e(4, -(I*b*d*x + I*a*d)/b)
)*cos(c)^2 + a^2*(exp_integral_e(4, (I*b*d*x + I*a*d)/b) + exp_integral_e(
4, -(I*b*d*x + I*a*d)/b))*sin(c)^2)*sin(-(b*c - a*d)/b))*sin(d*x + c)^2 +
((b^2*d*x^3*cos(c) + 3*a*b*x*sin(c))*cos(d*x + c)^2 + (b^2*d*x^3*cos(c) +
3*a*b*x*sin(c))*sin(d*x + c)^2)*cos(d*x + 2*c) + 6*(((a^2*b^5*cos(c)^2 + a
^2*b^5*sin(c)^2)*d^3*x^3 + 3*(a^3*b^4*cos(c)^2 + a^3*b^4*sin(c)^2)*d^3*x^2
 + 3*(a^4*b^3*cos(c)^2 + a^4*b^3*sin(c)^2)*d^3*x + (a^5*b^2*cos(c)^2 + a^5
*b^2*sin(c)^2)*d^3)*cos(d*x + c)^2 + ((a^2*b^5*cos(c)^2 + a^2*b^5*sin(c)^2
)*d^3*x^3 + 3*(a^3*b^4*cos(c)^2 + a^3*b^4*sin(c)^2)*d^3*x^2 + 3*(a^4*b^...
```

### 3.33.8 Giac [C] (verification not implemented)

Result contains higher order function than in optimal. Order 9 vs. order 4.

Time = 0.64 (sec) , antiderivative size = 16724, normalized size of antiderivative = 63.11

$$\int \frac{x^3 \sin(c+dx)}{(a+bx)^3} dx = \text{Too large to display}$$

input
```
integrate(x^3*sin(d*x+c)/(b*x+a)^3,x, algorithm="giac")
```

output
```
1/4*(a^3*b^2*d^3*x^2*imag_part(cos_integral(d*x + a*d/b))*tan(1/2*d*x)^2*t
an(1/2*c)^2*tan(1/2*a*d/b)^2 - a^3*b^2*d^3*x^2*imag_part(cos_integral(-d*x
 - a*d/b))*tan(1/2*d*x)^2*tan(1/2*c)^2*tan(1/2*a*d/b)^2 + 2*a^3*b^2*d^3*x^
2*sin_integral((b*d*x + a*d)/b)*tan(1/2*d*x)^2*tan(1/2*c)^2*tan(1/2*a*d/b)
^2 + 2*a^3*b^2*d^3*x^2*real_part(cos_integral(d*x + a*d/b))*tan(1/2*d*x)^2
*tan(1/2*c)^2*tan(1/2*a*d/b) + 2*a^3*b^2*d^3*x^2*real_part(cos_integral(-d
*x - a*d/b))*tan(1/2*d*x)^2*tan(1/2*c)^2*tan(1/2*a*d/b) - 2*a^3*b^2*d^3*x^
2*real_part(cos_integral(d*x + a*d/b))*tan(1/2*d*x)^2*tan(1/2*c)*tan(1/2*a
*d/b)^2 - 2*a^3*b^2*d^3*x^2*real_part(cos_integral(-d*x - a*d/b))*tan(1/2*
d*x)^2*tan(1/2*c)*tan(1/2*a*d/b)^2 + 2*a^4*b*d^3*x*imag_part(cos_integral(
d*x + a*d/b))*tan(1/2*d*x)^2*tan(1/2*c)^2*tan(1/2*a*d/b)^2 - 2*a^4*b*d^3*x
*imag_part(cos_integral(-d*x - a*d/b))*tan(1/2*d*x)^2*tan(1/2*c)^2*tan(1/2
*a*d/b)^2 + 6*a^2*b^3*d^2*x^2*real_part(cos_integral(d*x + a*d/b))*tan(1/2
*d*x)^2*tan(1/2*c)^2*tan(1/2*a*d/b)^2 + 6*a^2*b^3*d^2*x^2*real_part(cos_in
tegral(-d*x - a*d/b))*tan(1/2*d*x)^2*tan(1/2*c)^2*tan(1/2*a*d/b)^2 + 4*a^4
*b*d^3*x*sin_integral((b*d*x + a*d)/b)*tan(1/2*d*x)^2*tan(1/2*c)^2*tan(1/2
*a*d/b)^2 - a^3*b^2*d^3*x^2*imag_part(cos_integral(d*x + a*d/b))*tan(1/2*d
*x)^2*tan(1/2*c)^2 + a^3*b^2*d^3*x^2*imag_part(cos_integral(-d*x - a*d/b))
*tan(1/2*d*x)^2*tan(1/2*c)^2 - 2*a^3*b^2*d^3*x^2*sin_integral((b*d*x + a*d
)/b)*tan(1/2*d*x)^2*tan(1/2*c)^2 + 4*a^3*b^2*d^3*x^2*imag_part(cos_inte...
```

### 3.33.9 Mupad [F(-1)]

Timed out.

$$\int \frac{x^3 \sin(c+dx)}{(a+bx)^3} dx = \int \frac{x^3 \sin(c+d x)}{(a+b x)^3} dx$$

input
```
int((x^3*sin(c + d*x))/(a + b*x)^3,x)
```

output
```
int((x^3*sin(c + d*x))/(a + b*x)^3, x)
```

# 3.34 $\int \frac{x^2 \sin(c+dx)}{(a+bx)^3}\,dx$



## 3.34.1 Optimal result

Integrand size = 17, antiderivative size = 241

$$\begin{aligned}\int \frac{x^2\sin(c+dx)}{(a+bx)^3}\,dx = &-\frac{a^2d\cos(c+dx)}{2b^4(a+bx)}-\frac{2ad\cos\left(c-\frac{ad}{b}\right)\text{CosIntegral}\left(\frac{ad}{b}+dx\right)}{b^4}\\&+\frac{\text{CosIntegral}\left(\frac{ad}{b}+dx\right)\sin\left(c-\frac{ad}{b}\right)}{b^3}\\&-\frac{a^2d^2\,\text{CosIntegral}\left(\frac{ad}{b}+dx\right)\sin\left(c-\frac{ad}{b}\right)}{2b^5}-\frac{a^2\sin(c+dx)}{2b^3(a+bx)^2}\\&+\frac{2a\sin(c+dx)}{b^3(a+bx)}+\frac{\cos\left(c-\frac{ad}{b}\right)\text{Si}\left(\frac{ad}{b}+dx\right)}{b^3}\\&-\frac{a^2d^2\cos\left(c-\frac{ad}{b}\right)\text{Si}\left(\frac{ad}{b}+dx\right)}{2b^5}+\frac{2ad\sin\left(c-\frac{ad}{b}\right)\text{Si}\left(\frac{ad}{b}+dx\right)}{b^4}\end{aligned}$$

output
```
-2*a*d*Ci(a*d/b+d*x)*cos(-c+a*d/b)/b^4-1/2*a^2*d*cos(d*x+c)/b^4/(b*x+a)+co
s(-c+a*d/b)*Si(a*d/b+d*x)/b^3-1/2*a^2*d^2*cos(-c+a*d/b)*Si(a*d/b+d*x)/b^5-
Ci(a*d/b+d*x)*sin(-c+a*d/b)/b^3+1/2*a^2*d^2*Ci(a*d/b+d*x)*sin(-c+a*d/b)/b^
5-2*a*d*Si(a*d/b+d*x)*sin(-c+a*d/b)/b^4-1/2*a^2*sin(d*x+c)/b^3/(b*x+a)^2+2
*a*sin(d*x+c)/b^3/(b*x+a)
```

### 3.34.2 Mathematica [A] (verified)

Time = 0.85 (sec) , antiderivative size = 154, normalized size of antiderivative = 0.64

$$\int \frac{x^2 \sin(c+dx)}{(a+bx)^3} \, dx =$$
$$-\frac{-\operatorname{CosIntegral}\left(d\left(\frac{a}{b}+x\right)\right)\left(-4abd\cos\left(c-\frac{ad}{b}\right)+\left(2b^2-a^2d^2\right)\sin\left(c-\frac{ad}{b}\right)\right)+\frac{ab(ad(a+bx)\cos(c+dx)-b(3a+4b}{(a+bx)^2}}{2b^5}$$

input
```
Integrate[(x^2*Sin[c + d*x])/(a + b*x)^3,x]
```

output
```
-1/2*(-(CosIntegral[d*(a/b + x)]*(-4*a*b*d*Cos[c - (a*d)/b] + (2*b^2 - a^2
*d^2)*Sin[c - (a*d)/b])) + (a*b*(a*d*(a + b*x)*Cos[c + d*x] - b*(3*a + 4*b
*x)*Sin[c + d*x]))/(a + b*x)^2 + ((-2*b^2 + a^2*d^2)*Cos[c - (a*d)/b] - 4*
a*b*d*Sin[c - (a*d)/b])*SinIntegral[d*(a/b + x)])/b^5
```

### 3.34.3 Rubi [A] (verified)

Time = 0.74 (sec) , antiderivative size = 241, normalized size of antiderivative = 1.00, number of steps used = 2, number of rules used = 2, $\frac{\text{number of rules}}{\text{integrand size}}$ = 0.118, Rules used = {7293, 2009}

Below are the steps used by Rubi to obtain the solution. The rule number used for the transformation is given above next to the arrow. The rules definitions used are listed below.

$$\int \frac{x^2 \sin(c+dx)}{(a+bx)^3} \, dx$$
$$\Big\downarrow \; 7293$$
$$\int \left(\frac{a^2 \sin(c+dx)}{b^2(a+bx)^3}-\frac{2a \sin(c+dx)}{b^2(a+bx)^2}+\frac{\sin(c+dx)}{b^2(a+bx)}\right)dx$$
$$\Big\downarrow \; 2009$$
$$-\frac{a^2d^2\sin\left(c-\frac{ad}{b}\right)\operatorname{CosIntegral}\left(xd+\frac{ad}{b}\right)}{2b^5}-\frac{a^2d^2\cos\left(c-\frac{ad}{b}\right)\operatorname{Si}\left(xd+\frac{ad}{b}\right)}{2b^5}-\frac{a^2d\cos(c+dx)}{2b^4(a+bx)}-\frac{a^2\sin(c+dx)}{2b^3(a+bx)^2}-\frac{2ad\cos\left(c-\frac{ad}{b}\right)\operatorname{CosIntegral}\left(xd+\frac{ad}{b}\right)}{b^4}+\frac{2ad\sin\left(c-\frac{ad}{b}\right)\operatorname{Si}\left(xd+\frac{ad}{b}\right)}{b^4}+\frac{\sin\left(c-\frac{ad}{b}\right)\operatorname{CosIntegral}\left(xd+\frac{ad}{b}\right)}{b^3}+\frac{\cos\left(c-\frac{ad}{b}\right)\operatorname{Si}\left(xd+\frac{ad}{b}\right)}{b^3}+\frac{2a\sin(c+dx)}{b^3(a+bx)}$$

input
```
Int[(x^2*Sin[c + d*x])/(a + b*x)^3,x]
```

output
```
-1/2*(a^2*d*Cos[c + d*x])/(b^4*(a + b*x)) - (2*a*d*Cos[c - (a*d)/b]*CosInt
egral[(a*d)/b + d*x])/b^4 + (CosIntegral[(a*d)/b + d*x]*Sin[c - (a*d)/b])/
b^3 - (a^2*d^2*CosIntegral[(a*d)/b + d*x]*Sin[c - (a*d)/b])/(2*b^5) - (a^2
*Sin[c + d*x])/(2*b^3*(a + b*x)^2) + (2*a*Sin[c + d*x])/(b^3*(a + b*x)) +
(Cos[c - (a*d)/b]*SinIntegral[(a*d)/b + d*x])/b^3 - (a^2*d^2*Cos[c - (a*d)
/b]*SinIntegral[(a*d)/b + d*x])/(2*b^5) + (2*a*d*Sin[c - (a*d)/b]*SinInteg
ral[(a*d)/b + d*x])/b^4
```

### 3.34.3.1 Defintions of rubi rules used

rule 2009
```
Int[u_, x_Symbol] :> Simp[IntSum[u, x], x] /; SumQ[u]
```

rule 7293
```
Int[u_, x_Symbol] :> With[{v = ExpandIntegrand[u, x]}, Int[v, x] /; SumQ[v]
]
```

## 3.34.4 Maple [C] (verified)

Result contains complex when optimal does not.

Time = 0.39 (sec) , antiderivative size = 621, normalized size of antiderivative = 2.58

| method | result |
|---|---|
| risch | $-\frac{i\left(2ia^2b^3d^4x^3+6ia^3b^2d^4x^2+6ia^4bd^4x+2ia^5d^4\right)\cos(dx+c)}{4b^4d(bx+a)^2\left(-d^2x^2b^2-2abd^2x-d^2a^2\right)}-\frac{\left(8ab^3d^3x^3+22a^2b^2d^3x^2+20a^3bd^3x+6a^4d^3\right)\sin(dx+}{4b^3d(bx+a)^2\left(-d^2x^2b^2-2abd^2x-d^2a^2\right)}$ |
| derivativedivides | $\frac{d^3c^2\left(-\frac{\sin(dx+c)}{2(da-cb+b(dx+c))^2b}+\frac{-\frac{\cos(dx+c)}{(da-cb+b(dx+c))b}-\frac{\frac{\mathrm{Si}\left(dx+c+\frac{da-cb}{b}\right)\cos\left(\frac{da-cb}{b}\right)}{b}-\frac{\mathrm{Ci}\left(dx+c+\frac{da-cb}{b}\right)\sin\left(\frac{da-cb}{b}\right)}{b}}{b}}{2b}\right)+\frac{2d^3}{}}{}$ |
| default | $\frac{d^3c^2\left(-\frac{\sin(dx+c)}{2(da-cb+b(dx+c))^2b}+\frac{-\frac{\cos(dx+c)}{(da-cb+b(dx+c))b}-\frac{\frac{\mathrm{Si}\left(dx+c+\frac{da-cb}{b}\right)\cos\left(\frac{da-cb}{b}\right)}{b}-\frac{\mathrm{Ci}\left(dx+c+\frac{da-cb}{b}\right)\sin\left(\frac{da-cb}{b}\right)}{b}}{b}}{2b}\right)+\frac{2d^3}{}}{}$ |

input
```
int(x^2*sin(d*x+c)/(b*x+a)^3,x,method=_RETURNVERBOSE)
```

output
```
-1/4*I/b^4/d*(2*I*a^2*b^3*d^4*x^3+6*I*a^3*b^2*d^4*x^2+6*I*a^4*b*d^4*x+2*I*
a^5*d^4)/(b*x+a)^2/(-b^2*d^2*x^2-2*a*b*d^2*x-a^2*d^2)*cos(d*x+c)-1/4/b^3/d
*(8*a*b^3*d^3*x^3+22*a^2*b^2*d^3*x^2+20*a^3*b*d^3*x+6*a^4*d^3)/(b*x+a)^2/(
-b^2*d^2*x^2-2*a*b*d^2*x-a^2*d^2)*sin(d*x+c)+1/4*I/b^5*cos((a*d-b*c)/b)*Ei
(1,I*d*(b*x+a)/b)*a^2*d^2-1/4*I/b^5*cos((a*d-b*c)/b)*Ei(1,-I*d*(b*x+a)/b)*
a^2*d^2-1/2*I/b^3*cos((a*d-b*c)/b)*Ei(1,I*d*(b*x+a)/b)+1/b^4*cos((a*d-b*c)
/b)*Ei(1,I*d*(b*x+a)/b)*a*d+1/2*I/b^3*cos((a*d-b*c)/b)*Ei(1,-I*d*(b*x+a)/b
)+1/b^4*cos((a*d-b*c)/b)*Ei(1,-I*d*(b*x+a)/b)*a*d-1/4/b^5*sin((a*d-b*c)/b)
*Ei(1,I*d*(b*x+a)/b)*a^2*d^2-1/4/b^5*sin((a*d-b*c)/b)*Ei(1,-I*d*(b*x+a)/b)
*a^2*d^2+1/2/b^3*sin((a*d-b*c)/b)*Ei(1,I*d*(b*x+a)/b)+I/b^4*sin((a*d-b*c)/
b)*Ei(1,I*d*(b*x+a)/b)*a*d+1/2/b^3*sin((a*d-b*c)/b)*Ei(1,-I*d*(b*x+a)/b)-I
/b^4*sin((a*d-b*c)/b)*Ei(1,-I*d*(b*x+a)/b)*a*d
```

### 3.34.5 Fricas [A] (verification not implemented)

Time = 0.30 (sec) , antiderivative size = 325, normalized size of antiderivative = 1.35

$$\int \frac{x^2 \sin(c+dx)}{(a+bx)^3} \, dx =$$
$$-\frac{(a^2b^2dx + a^3bd)\cos(dx+c) + \left(4\left(ab^3dx^2 + 2\,a^2b^2dx + a^3bd\right)\operatorname{Ci}\left(\frac{bdx+ad}{b}\right) + (a^4d^2 - 2\,a^2b^2 + (a^2b^2d^2 - \cdots}{\cdots}$$

input
```
integrate(x^2*sin(d*x+c)/(b*x+a)^3,x, algorithm="fricas")
```

output
```
-1/2*((a^2*b^2*d*x + a^3*b*d)*cos(d*x + c) + (4*(a*b^3*d*x^2 + 2*a^2*b^2*d
*x + a^3*b*d)*cos_integral((b*d*x + a*d)/b) + (a^4*d^2 - 2*a^2*b^2 + (a^2*
b^2*d^2 - 2*b^4)*x^2 + 2*(a^3*b*d^2 - 2*a*b^3)*x)*sin_integral((b*d*x + a*
d)/b))*cos(-(b*c - a*d)/b) - (4*a*b^3*x + 3*a^2*b^2)*sin(d*x + c) - ((a^4*
d^2 - 2*a^2*b^2 + (a^2*b^2*d^2 - 2*b^4)*x^2 + 2*(a^3*b*d^2 - 2*a*b^3)*x)*c
os_integral((b*d*x + a*d)/b) - 4*(a*b^3*d*x^2 + 2*a^2*b^2*d*x + a^3*b*d)*s
in_integral((b*d*x + a*d)/b))*sin(-(b*c - a*d)/b))/(b^7*x^2 + 2*a*b^6*x +
a^2*b^5)
```

### 3.34.6 Sympy [F]

$$\int \frac{x^2 \sin(c+dx)}{(a+bx)^3}\,dx = \int \frac{x^2 \sin{(c+dx)}}{(a+bx)^3}\,dx$$

input
```
integrate(x**2*sin(d*x+c)/(b*x+a)**3,x)
```

output
```
Integral(x**2*sin(c + d*x)/(a + b*x)**3, x)
```

### 3.34.7 Maxima [F]

$$\int \frac{x^2 \sin(c+dx)}{(a+bx)^3}\,dx = \int \frac{x^2 \sin{(dx+c)}}{(bx+a)^3}\,dx$$

input
```
integrate(x^2*sin(d*x+c)/(b*x+a)^3,x, algorithm="maxima")
```

output
```
-1/2*((b*cos(c)^2 + b*sin(c)^2)*d*x^2*cos(d*x + c) + ((a*(I*exp_integral_e
(4, (I*b*d*x + I*a*d)/b) - I*exp_integral_e(4, -(I*b*d*x + I*a*d)/b))*cos(
c)^2 + a*(I*exp_integral_e(4, (I*b*d*x + I*a*d)/b) - I*exp_integral_e(4, -
(I*b*d*x + I*a*d)/b))*sin(c)^2)*cos(-(b*c - a*d)/b) - (a*(exp_integral_e(4
, (I*b*d*x + I*a*d)/b) + exp_integral_e(4, -(I*b*d*x + I*a*d)/b))*cos(c)^2
 + a*(exp_integral_e(4, (I*b*d*x + I*a*d)/b) + exp_integral_e(4, -(I*b*d*x
 + I*a*d)/b))*sin(c)^2)*sin(-(b*c - a*d)/b))*cos(d*x + c)^2 + (b*cos(c)^2
+ b*sin(c)^2)*x*sin(d*x + c) + ((a*(I*exp_integral_e(4, (I*b*d*x + I*a*d)/
b) - I*exp_integral_e(4, -(I*b*d*x + I*a*d)/b))*cos(c)^2 + a*(I*exp_integr
al_e(4, (I*b*d*x + I*a*d)/b) - I*exp_integral_e(4, -(I*b*d*x + I*a*d)/b))*
sin(c)^2)*cos(-(b*c - a*d)/b) - (a*(exp_integral_e(4, (I*b*d*x + I*a*d)/b)
 + exp_integral_e(4, -(I*b*d*x + I*a*d)/b))*cos(c)^2 + a*(exp_integral_e(4
, (I*b*d*x + I*a*d)/b) + exp_integral_e(4, -(I*b*d*x + I*a*d)/b))*sin(c)^2
)*sin(-(b*c - a*d)/b))*sin(d*x + c)^2 + ((b*d*x^2*cos(c) - b*x*sin(c))*cos
(d*x + c)^2 + (b*d*x^2*cos(c) - b*x*sin(c))*sin(d*x + c)^2)*cos(d*x + 2*c)
 - 6*(((a*b^4*cos(c)^2 + a*b^4*sin(c)^2)*d^3*x^3 + 3*(a^2*b^3*cos(c)^2 + a
^2*b^3*sin(c)^2)*d^3*x^2 + 3*(a^3*b^2*cos(c)^2 + a^3*b^2*sin(c)^2)*d^3*x +
 (a^4*b*cos(c)^2 + a^4*b*sin(c)^2)*d^3)*cos(d*x + c)^2 + ((a*b^4*cos(c)^2
+ a*b^4*sin(c)^2)*d^3*x^3 + 3*(a^2*b^3*cos(c)^2 + a^2*b^3*sin(c)^2)*d^3*x^
2 + 3*(a^3*b^2*cos(c)^2 + a^3*b^2*sin(c)^2)*d^3*x + (a^4*b*cos(c)^2 + a...
```

### 3.34.8 Giac [C] (verification not implemented)

Result contains higher order function than in optimal. Order 9 vs. order 4.

Time = 0.62 (sec) , antiderivative size = 15410, normalized size of antiderivative = 63.94

$$\int \frac{x^2 \sin(c+dx)}{(a+bx)^3} \, dx = \text{Too large to display}$$

input
```
integrate(x^2*sin(d*x+c)/(b*x+a)^3,x, algorithm="giac")
```

output
```
-1/4*(a^2*b^2*d^2*x^2*imag_part(cos_integral(d*x + a*d/b))*tan(1/2*d*x)^2*
tan(1/2*c)^2*tan(1/2*a*d/b)^2 - a^2*b^2*d^2*x^2*imag_part(cos_integral(-d*
x - a*d/b))*tan(1/2*d*x)^2*tan(1/2*c)^2*tan(1/2*a*d/b)^2 + 2*a^2*b^2*d^2*x
^2*sin_integral((b*d*x + a*d)/b)*tan(1/2*d*x)^2*tan(1/2*c)^2*tan(1/2*a*d/b
)^2 + 2*a^2*b^2*d^2*x^2*real_part(cos_integral(d*x + a*d/b))*tan(1/2*d*x)^
2*tan(1/2*c)^2*tan(1/2*a*d/b) + 2*a^2*b^2*d^2*x^2*real_part(cos_integral(-
d*x - a*d/b))*tan(1/2*d*x)^2*tan(1/2*c)^2*tan(1/2*a*d/b) - 2*a^2*b^2*d^2*x
^2*real_part(cos_integral(d*x + a*d/b))*tan(1/2*d*x)^2*tan(1/2*c)*tan(1/2*
a*d/b)^2 - 2*a^2*b^2*d^2*x^2*real_part(cos_integral(-d*x - a*d/b))*tan(1/2
*d*x)^2*tan(1/2*c)*tan(1/2*a*d/b)^2 + 2*a^3*b*d^2*x*imag_part(cos_integral
(d*x + a*d/b))*tan(1/2*d*x)^2*tan(1/2*c)^2*tan(1/2*a*d/b)^2 - 2*a^3*b*d^2*
x*imag_part(cos_integral(-d*x - a*d/b))*tan(1/2*d*x)^2*tan(1/2*c)^2*tan(1/
2*a*d/b)^2 + 4*a*b^3*d*x^2*real_part(cos_integral(d*x + a*d/b))*tan(1/2*d*
x)^2*tan(1/2*c)^2*tan(1/2*a*d/b)^2 + 4*a*b^3*d*x^2*real_part(cos_integral(
-d*x - a*d/b))*tan(1/2*d*x)^2*tan(1/2*c)^2*tan(1/2*a*d/b)^2 + 4*a^3*b*d^2*
x*sin_integral((b*d*x + a*d)/b)*tan(1/2*d*x)^2*tan(1/2*c)^2*tan(1/2*a*d/b)
^2 - a^2*b^2*d^2*x^2*imag_part(cos_integral(d*x + a*d/b))*tan(1/2*d*x)^2*t
an(1/2*c)^2 + a^2*b^2*d^2*x^2*imag_part(cos_integral(-d*x - a*d/b))*tan(1/
2*d*x)^2*tan(1/2*c)^2 - 2*a^2*b^2*d^2*x^2*sin_integral((b*d*x + a*d)/b)*ta
n(1/2*d*x)^2*tan(1/2*c)^2 + 4*a^2*b^2*d^2*x^2*imag_part(cos_integral(d*...
```

### 3.34.9 Mupad [F(-1)]

Timed out.

$$\int \frac{x^2 \sin(c+dx)}{(a+bx)^3} \, dx = \int \frac{x^2 \sin(c+d\,x)}{(a+b\,x)^3} \, dx$$

input
```
int((x^2*sin(c + d*x))/(a + b*x)^3,x)
```

output
```
int((x^2*sin(c + d*x))/(a + b*x)^3, x)
```

# 3.35 $\int \frac{x\sin(c+dx)}{(a+bx)^3}\,dx$



## 3.35.1 Optimal result

Integrand size = 15, antiderivative size = 179

$$\begin{aligned}\int \frac{x\sin(c+dx)}{(a+bx)^3}\,dx =& \frac{ad\cos(c+dx)}{2b^3(a+bx)}+\frac{d\cos\left(c-\frac{ad}{b}\right)\text{CosIntegral}\left(\frac{ad}{b}+dx\right)}{b^3}\\&+\frac{ad^2\,\text{CosIntegral}\left(\frac{ad}{b}+dx\right)\sin\left(c-\frac{ad}{b}\right)}{2b^4}+\frac{a\sin(c+dx)}{2b^2(a+bx)^2}-\frac{\sin(c+dx)}{b^2(a+bx)}\\&+\frac{ad^2\cos\left(c-\frac{ad}{b}\right)\text{Si}\left(\frac{ad}{b}+dx\right)}{2b^4}-\frac{d\sin\left(c-\frac{ad}{b}\right)\text{Si}\left(\frac{ad}{b}+dx\right)}{b^3}\end{aligned}$$

output
```
d*Ci(a*d/b+d*x)*cos(-c+a*d/b)/b^3+1/2*a*d*cos(d*x+c)/b^3/(b*x+a)+1/2*a*d^2
*cos(-c+a*d/b)*Si(a*d/b+d*x)/b^4-1/2*a*d^2*Ci(a*d/b+d*x)*sin(-c+a*d/b)/b^4
+d*Si(a*d/b+d*x)*sin(-c+a*d/b)/b^3+1/2*a*sin(d*x+c)/b^2/(b*x+a)^2-sin(d*x+
c)/b^2/(b*x+a)
```

## 3.35.2 Mathematica [A] (verified)

Time = 0.39 (sec) , antiderivative size = 157, normalized size of antiderivative = 0.88

$$\int \frac{x\sin(c+dx)}{(a+bx)^3}\,dx$$
$$= \frac{b\cos(dx)(ad(a+bx)\cos(c)-b(a+2bx)\sin(c))-b(b(a+2bx)\cos(c)+ad(a+bx)\sin(c))\sin(dx)+d(a}{}$$

input
```
Integrate[(x*Sin[c + d*x])/(a + b*x)^3,x]
```

output
```
(b*Cos[d*x]*(a*d*(a + b*x)*Cos[c] - b*(a + 2*b*x)*Sin[c]) - b*(b*(a + 2*b*
x)*Cos[c] + a*d*(a + b*x)*Sin[c])*Sin[d*x] + d*(a + b*x)^2*(CosIntegral[d*
(a/b + x)]*(2*b*Cos[c - (a*d)/b] + a*d*Sin[c - (a*d)/b]) + (a*d*Cos[c - (a
*d)/b] - 2*b*Sin[c - (a*d)/b])*SinIntegral[d*(a/b + x)]))/(2*b^4*(a + b*x)
^2)
```

### 3.35.3 Rubi [A] (verified)

Time = 0.56 (sec) , antiderivative size = 179, normalized size of antiderivative = 1.00, number of steps used = 2, number of rules used = 2, $\frac{\text{number of rules}}{\text{integrand size}}$ = 0.133, Rules used = {7293, 2009}

Below are the steps used by Rubi to obtain the solution. The rule number used for the transformation is given above next to the arrow. The rules definitions used are listed below.

$$\int \frac{x \sin(c+dx)}{(a+bx)^3} \, dx$$

$$\Big\downarrow \text{7293}$$

$$\int \left(\frac{\sin(c+dx)}{b(a+bx)^2}-\frac{a \sin(c+dx)}{b(a+bx)^3}\right)dx$$

$$\Big\downarrow \text{2009}$$

$$\frac{ad^2 \sin\left(c-\frac{ad}{b}\right) \text{CosIntegral}\left(xd+\frac{ad}{b}\right)}{2b^4}+\frac{ad^2 \cos\left(c-\frac{ad}{b}\right) \text{Si}\left(xd+\frac{ad}{b}\right)}{2b^4}+\frac{d \cos\left(c-\frac{ad}{b}\right) \text{CosIntegral}\left(xd+\frac{ad}{b}\right)}{b^3}-\frac{d \sin\left(c-\frac{ad}{b}\right) \text{Si}\left(xd+\frac{ad}{b}\right)}{b^3}+\frac{ad \cos(c+dx)}{2b^3(a+bx)}-\frac{\sin(c+dx)}{b^2(a+bx)}+\frac{a \sin(c+dx)}{2b^2(a+bx)^2}$$

input
```
Int[(x*Sin[c + d*x])/(a + b*x)^3,x]
```

output
```
(a*d*Cos[c + d*x])/(2*b^3*(a + b*x)) + (d*Cos[c - (a*d)/b]*CosIntegral[(a*
d)/b + d*x])/b^3 + (a*d^2*CosIntegral[(a*d)/b + d*x]*Sin[c - (a*d)/b])/(2*
b^4) + (a*Sin[c + d*x])/(2*b^2*(a + b*x)^2) - Sin[c + d*x]/(b^2*(a + b*x))
 + (a*d^2*Cos[c - (a*d)/b]*SinIntegral[(a*d)/b + d*x])/(2*b^4) - (d*Sin[c
- (a*d)/b]*SinIntegral[(a*d)/b + d*x])/b^3
```

### 3.35.3.1 Defintions of rubi rules used

rule 2009
```
Int[u_, x_Symbol] :> Simp[IntSum[u, x], x] /; SumQ[u]
```

rule 7293
```
Int[u_, x_Symbol] :> With[{v = ExpandIntegrand[u, x]}, Int[v, x] /; SumQ[v]
]
```

## 3.35.4 Maple [B] (verified)

Leaf count of result is larger than twice the leaf count of optimal. 418 vs. $2(174) = 348$.

Time = 0.35 (sec) , antiderivative size = 419, normalized size of antiderivative = 2.34

| method | result |
|---|---|
| derivativedivides | $\dfrac{\dfrac{d^3\left(-\frac{\sin(dx+c)}{(da-cb+b(dx+c))b}+\frac{\frac{\operatorname{Si}\left(dx+c+\frac{da-cb}{b}\right)\sin\left(\frac{da-cb}{b}\right)}{b}+\frac{\operatorname{Ci}\left(dx+c+\frac{da-cb}{b}\right)\cos\left(\frac{da-cb}{b}\right)}{b}}{b}\right)}{b}-\dfrac{(da-cb)d^3\left(-\frac{\sin(dx+c)}{2(da-cb+b(dx+c))}\right.}{}}{}$ |
| default | $\dfrac{\dfrac{d^3\left(-\frac{\sin(dx+c)}{(da-cb+b(dx+c))b}+\frac{\frac{\operatorname{Si}\left(dx+c+\frac{da-cb}{b}\right)\sin\left(\frac{da-cb}{b}\right)}{b}+\frac{\operatorname{Ci}\left(dx+c+\frac{da-cb}{b}\right)\cos\left(\frac{da-cb}{b}\right)}{b}}{b}\right)}{b}-\dfrac{(da-cb)d^3\left(-\frac{\sin(dx+c)}{2(da-cb+b(dx+c))}\right.}{}}{}$ |
| risch | $\frac{i\left(2ia\,b^3d^3x^3+6ia^2b^2d^3x^2+6ia^3b\,d^3x+2ia^4d^3\right)\cos(dx+c)}{4b^3(bx+a)^2\left(-d^2x^2b^2-2ab\,d^2x-d^2a^2\right)}+\frac{\left(4b^4d^2x^3+10a\,b^3d^2x^2+8a^2b^2d^2x+2a^3b\,d^2\right)\sin(dx+c)}{4b^3(bx+a)^2\left(-d^2x^2b^2-2ab\,d^2x-d^2a^2\right)}-$ |

input
```
int(x*sin(d*x+c)/(b*x+a)^3,x,method=_RETURNVERBOSE)
```

output
```
1/d^2*(d^3/b*(-sin(d*x+c)/(d*a-c*b+b*(d*x+c))/b+(Si(d*x+c+(a*d-b*c)/b)*sin
((a*d-b*c)/b)/b+Ci(d*x+c+(a*d-b*c)/b)*cos((a*d-b*c)/b)/b)/b)-(a*d-b*c)/b*d
^3*(-1/2*sin(d*x+c)/(d*a-c*b+b*(d*x+c))^2/b+1/2*(-cos(d*x+c)/(d*a-c*b+b*(d
*x+c))/b-(Si(d*x+c+(a*d-b*c)/b)*cos((a*d-b*c)/b)/b-Ci(d*x+c+(a*d-b*c)/b)*s
in((a*d-b*c)/b)/b)/b)/b)-d^3*c*(-1/2*sin(d*x+c)/(d*a-c*b+b*(d*x+c))^2/b+1/
2*(-cos(d*x+c)/(d*a-c*b+b*(d*x+c))/b-(Si(d*x+c+(a*d-b*c)/b)*cos((a*d-b*c)/
b)/b-Ci(d*x+c+(a*d-b*c)/b)*sin((a*d-b*c)/b)/b)/b)/b))
```

### 3.35.5 Fricas [A] (verification not implemented)

Time = 0.31 (sec) , antiderivative size = 263, normalized size of antiderivative = 1.47

$$\int \frac{x\sin(c+dx)}{(a+bx)^3}\,dx$$
$$= (ab^2dx + a^2bd)\cos(dx+c) + \left(2\left(b^3dx^2 + 2\,ab^2dx + a^2bd\right)\operatorname{Ci}\left(\frac{bdx+ad}{b}\right) + \left(ab^2d^2x^2 + 2\,a^2bd^2x + a^3d^2\right)\operatorname{Si}\left(\right.\right.$$

input
```
integrate(x*sin(d*x+c)/(b*x+a)^3,x, algorithm="fricas")
```

output
```
1/2*((a*b^2*d*x + a^2*b*d)*cos(d*x + c) + (2*(b^3*d*x^2 + 2*a*b^2*d*x + a^
2*b*d)*cos_integral((b*d*x + a*d)/b) + (a*b^2*d^2*x^2 + 2*a^2*b*d^2*x + a^
3*d^2)*sin_integral((b*d*x + a*d)/b))*cos(-(b*c - a*d)/b) - (2*b^3*x + a*b
^2)*sin(d*x + c) - ((a*b^2*d^2*x^2 + 2*a^2*b*d^2*x + a^3*d^2)*cos_integral
((b*d*x + a*d)/b) - 2*(b^3*d*x^2 + 2*a*b^2*d*x + a^2*b*d)*sin_integral((b*
d*x + a*d)/b))*sin(-(b*c - a*d)/b))/(b^6*x^2 + 2*a*b^5*x + a^2*b^4)
```

### 3.35.6 Sympy [F]

$$\int \frac{x\sin(c+dx)}{(a+bx)^3}\,dx = \int \frac{x\sin(c+dx)}{(a+bx)^3}\,dx$$

input
```
integrate(x*sin(d*x+c)/(b*x+a)**3,x)
```

output
```
Integral(x*sin(c + d*x)/(a + b*x)**3, x)
```

### 3.35.7 Maxima [F]

$$\int \frac{x\sin(c+dx)}{(a+bx)^3}\,dx = \int \frac{x\sin(dx+c)}{(bx+a)^3}\,dx$$

input
```
integrate(x*sin(d*x+c)/(b*x+a)^3,x, algorithm="maxima")
```

output
```
-1/2*((b*cos(c)^2 + b*sin(c)^2)*x*cos(d*x + c) + ((a*(exp_integral_e(4, (I
*b*d*x + I*a*d)/b) + exp_integral_e(4, -(I*b*d*x + I*a*d)/b))*cos(c)^2 + a
*(exp_integral_e(4, (I*b*d*x + I*a*d)/b) + exp_integral_e(4, -(I*b*d*x + I
*a*d)/b))*sin(c)^2)*cos(-(b*c - a*d)/b) + (a*(I*exp_integral_e(4, (I*b*d*x
 + I*a*d)/b) - I*exp_integral_e(4, -(I*b*d*x + I*a*d)/b))*cos(c)^2 + a*(I*
exp_integral_e(4, (I*b*d*x + I*a*d)/b) - I*exp_integral_e(4, -(I*b*d*x + I
*a*d)/b))*sin(c)^2)*sin(-(b*c - a*d)/b))*cos(d*x + c)^2 + ((a*(exp_integra
l_e(4, (I*b*d*x + I*a*d)/b) + exp_integral_e(4, -(I*b*d*x + I*a*d)/b))*cos
(c)^2 + a*(exp_integral_e(4, (I*b*d*x + I*a*d)/b) + exp_integral_e(4, -(I*
b*d*x + I*a*d)/b))*sin(c)^2)*cos(-(b*c - a*d)/b) + (a*(I*exp_integral_e(4,
 (I*b*d*x + I*a*d)/b) - I*exp_integral_e(4, -(I*b*d*x + I*a*d)/b))*cos(c)^
2 + a*(I*exp_integral_e(4, (I*b*d*x + I*a*d)/b) - I*exp_integral_e(4, -(I*
b*d*x + I*a*d)/b))*sin(c)^2)*sin(-(b*c - a*d)/b))*sin(d*x + c)^2 + (b*x*co
s(d*x + c)^2*cos(c) + b*x*cos(c)*sin(d*x + c)^2)*cos(d*x + 2*c) + 4*(((b^5
*cos(c)^2 + b^5*sin(c)^2)*d*x^3 + 3*(a*b^4*cos(c)^2 + a*b^4*sin(c)^2)*d*x^
2 + 3*(a^2*b^3*cos(c)^2 + a^2*b^3*sin(c)^2)*d*x + (a^3*b^2*cos(c)^2 + a^3*
b^2*sin(c)^2)*d)*cos(d*x + c)^2 + ((b^5*cos(c)^2 + b^5*sin(c)^2)*d*x^3 + 3
*(a*b^4*cos(c)^2 + a*b^4*sin(c)^2)*d*x^2 + 3*(a^2*b^3*cos(c)^2 + a^2*b^3*s
in(c)^2)*d*x + (a^3*b^2*cos(c)^2 + a^3*b^2*sin(c)^2)*d)*sin(d*x + c)^2)*in
tegrate(1/2*x*cos(d*x + c)/(b^4*d*x^4 + 4*a*b^3*d*x^3 + 6*a^2*b^2*d*x^2...
```

### 3.35.8 Giac [C] (verification not implemented)

Result contains higher order function than in optimal. Order 9 vs. order 4.

Time = 0.54 (sec) , antiderivative size = 10535, normalized size of antiderivative = 58.85

$$\int \frac{x\sin(c+dx)}{(a+bx)^3}\,dx = \text{Too large to display}$$

input
```
integrate(x*sin(d*x+c)/(b*x+a)^3,x, algorithm="giac")
```

output
```
1/4*(a*b^2*d^2*x^2*imag_part(cos_integral(d*x + a*d/b))*tan(1/2*d*x)^2*tan
(1/2*c)^2*tan(1/2*a*d/b)^2 - a*b^2*d^2*x^2*imag_part(cos_integral(-d*x - a
*d/b))*tan(1/2*d*x)^2*tan(1/2*c)^2*tan(1/2*a*d/b)^2 + 2*a*b^2*d^2*x^2*sin_
integral((b*d*x + a*d)/b)*tan(1/2*d*x)^2*tan(1/2*c)^2*tan(1/2*a*d/b)^2 + 2
*a*b^2*d^2*x^2*real_part(cos_integral(d*x + a*d/b))*tan(1/2*d*x)^2*tan(1/2
*c)^2*tan(1/2*a*d/b) + 2*a*b^2*d^2*x^2*real_part(cos_integral(-d*x - a*d/b
))*tan(1/2*d*x)^2*tan(1/2*c)^2*tan(1/2*a*d/b) - 2*a*b^2*d^2*x^2*real_part(
cos_integral(d*x + a*d/b))*tan(1/2*d*x)^2*tan(1/2*c)*tan(1/2*a*d/b)^2 - 2*
a*b^2*d^2*x^2*real_part(cos_integral(-d*x - a*d/b))*tan(1/2*d*x)^2*tan(1/2
*c)*tan(1/2*a*d/b)^2 + 2*a^2*b*d^2*x*imag_part(cos_integral(d*x + a*d/b))*
tan(1/2*d*x)^2*tan(1/2*c)^2*tan(1/2*a*d/b)^2 - 2*a^2*b*d^2*x*imag_part(cos
_integral(-d*x - a*d/b))*tan(1/2*d*x)^2*tan(1/2*c)^2*tan(1/2*a*d/b)^2 + 2*
b^3*d*x^2*real_part(cos_integral(d*x + a*d/b))*tan(1/2*d*x)^2*tan(1/2*c)^2
*tan(1/2*a*d/b)^2 + 2*b^3*d*x^2*real_part(cos_integral(-d*x - a*d/b))*tan(
1/2*d*x)^2*tan(1/2*c)^2*tan(1/2*a*d/b)^2 + 4*a^2*b*d^2*x*sin_integral((b*d
*x + a*d)/b)*tan(1/2*d*x)^2*tan(1/2*c)^2*tan(1/2*a*d/b)^2 - a*b^2*d^2*x^2*
imag_part(cos_integral(d*x + a*d/b))*tan(1/2*d*x)^2*tan(1/2*c)^2 + a*b^2*d
^2*x^2*imag_part(cos_integral(-d*x - a*d/b))*tan(1/2*d*x)^2*tan(1/2*c)^2 -
 2*a*b^2*d^2*x^2*sin_integral((b*d*x + a*d)/b)*tan(1/2*d*x)^2*tan(1/2*c)^2
 + 4*a*b^2*d^2*x^2*imag_part(cos_integral(d*x + a*d/b))*tan(1/2*d*x)^2*...
```

### 3.35.9 Mupad [F(-1)]

Timed out.

$$\int \frac{x\sin(c+dx)}{(a+bx)^3}\,dx=\int \frac{x\,\sin\left(c+d\,x\right)}{{\left(a+b\,x\right)}^3}\,dx$$

input
```
int((x*sin(c + d*x))/(a + b*x)^3,x)
```

output
```
int((x*sin(c + d*x))/(a + b*x)^3, x)
```

# 3.36 $\int \frac{\sin(c+dx)}{(a+bx)^3} dx$



## 3.36.1 Optimal result

Integrand size = 14, antiderivative size = 104

$$\int \frac{\sin(c+dx)}{(a+bx)^3} dx = -\frac{d\cos(c+dx)}{2b^2(a+bx)} - \frac{d^2 \operatorname{CosIntegral}\left(\frac{ad}{b}+dx\right)\sin\left(c-\frac{ad}{b}\right)}{2b^3} - \frac{\sin(c+dx)}{2b(a+bx)^2} - \frac{d^2\cos\left(c-\frac{ad}{b}\right)\operatorname{Si}\left(\frac{ad}{b}+dx\right)}{2b^3}$$

output
```
-1/2*d*cos(d*x+c)/b^2/(b*x+a)-1/2*d^2*cos(-c+a*d/b)*Si(a*d/b+d*x)/b^3+1/2*
d^2*Ci(a*d/b+d*x)*sin(-c+a*d/b)/b^3-1/2*sin(d*x+c)/b/(b*x+a)^2
```

## 3.36.2 Mathematica [A] (verified)

Time = 0.48 (sec) , antiderivative size = 87, normalized size of antiderivative = 0.84

$$\int \frac{\sin(c+dx)}{(a+bx)^3} dx = -\frac{d^2 \operatorname{CosIntegral}\left(d\left(\frac{a}{b}+x\right)\right)\sin\left(c-\frac{ad}{b}\right) + \frac{b(d(a+bx)\cos(c+dx)+b\sin(c+dx))}{(a+bx)^2} + d^2\cos\left(c-\frac{ad}{b}\right)\operatorname{Si}\left(d\left(\frac{a}{b}+x\right)\right)}{2b^3}$$

input
```
Integrate[Sin[c + d*x]/(a + b*x)^3,x]
```

output
```
-1/2*(d^2*CosIntegral[d*(a/b + x)]*Sin[c - (a*d)/b] + (b*(d*(a + b*x)*Cos[
c + d*x] + b*Sin[c + d*x]))/(a + b*x)^2 + d^2*Cos[c - (a*d)/b]*SinIntegral
[d*(a/b + x)])/b^3
```

### 3.36.3 Rubi [A] (verified)

Time = 0.59 (sec) , antiderivative size = 105, normalized size of antiderivative = 1.01, number of steps used = 10, number of rules used = 10, $\frac{\text{number of rules}}{\text{integrand size}}$ = 0.714, Rules used = {3042, 3778, 3042, 3778, 25, 3042, 3784, 3042, 3780, 3783}

Below are the steps used by Rubi to obtain the solution. The rule number used for the transformation is given above next to the arrow. The rules definitions used are listed below.

$$\int \frac{\sin(c+dx)}{(a+bx)^3} \, dx$$

$$\Big\downarrow \text{3042}$$

$$\int \frac{\sin(c+dx)}{(a+bx)^3}dx$$

$$\Big\downarrow \text{3778}$$

$$\frac{d\int \frac{\cos(c+dx)}{(a+bx)^2}dx}{2b}-\frac{\sin(c+dx)}{2b(a+bx)^2}$$

$$\Big\downarrow \text{3042}$$

$$\frac{d\int \frac{\sin\left(c+dx+\frac{\pi}{2}\right)}{(a+bx)^2}dx}{2b}-\frac{\sin(c+dx)}{2b(a+bx)^2}$$

$$\Big\downarrow \text{3778}$$

$$\frac{d\left(\frac{d\int -\frac{\sin(c+dx)}{a+bx}dx}{b}-\frac{\cos(c+dx)}{b(a+bx)}\right)}{2b}-\frac{\sin(c+dx)}{2b(a+bx)^2}$$

$$\Big\downarrow \text{25}$$

$$\frac{d\left(-\frac{d\int \frac{\sin(c+dx)}{a+bx}dx}{b}-\frac{\cos(c+dx)}{b(a+bx)}\right)}{2b}-\frac{\sin(c+dx)}{2b(a+bx)^2}$$

$$\Big\downarrow \text{3042}$$

$$\frac{d\left(-\frac{d\int \frac{\sin(c+dx)}{a+bx}dx}{b}-\frac{\cos(c+dx)}{b(a+bx)}\right)}{2b}-\frac{\sin(c+dx)}{2b(a+bx)^2}$$

$$\Big\downarrow \text{3784}$$

$$\frac{d\left(-\frac{d\left(\sin\left(c-\frac{ad}{b}\right)\int\frac{\cos\left(xd+\frac{ad}{b}\right)}{a+bx}dx+\cos\left(c-\frac{ad}{b}\right)\int\frac{\sin\left(xd+\frac{ad}{b}\right)}{a+bx}dx\right)}{b}-\frac{\cos(c+dx)}{b(a+bx)}\right)}{2b}-\frac{\sin(c+dx)}{2b(a+bx)^2}$$

$$\Big\downarrow \text{3042}$$

$$\frac{d\left(-\frac{d\left(\sin\left(c-\frac{ad}{b}\right)\int\frac{\sin\left(xd+\frac{ad}{b}+\frac{\pi}{2}\right)}{a+bx}dx+\cos\left(c-\frac{ad}{b}\right)\int\frac{\sin\left(xd+\frac{ad}{b}\right)}{a+bx}dx\right)}{b}-\frac{\cos(c+dx)}{b(a+bx)}\right)}{2b}-\frac{\sin(c+dx)}{2b(a+bx)^2}$$

$$\Big\downarrow \text{3780}$$

$$\frac{d\left(-\frac{d\left(\sin\left(c-\frac{ad}{b}\right)\int\frac{\sin\left(xd+\frac{ad}{b}+\frac{\pi}{2}\right)}{a+bx}dx+\frac{\cos\left(c-\frac{ad}{b}\right)\text{Si}\left(xd+\frac{ad}{b}\right)}{b}\right)}{b}-\frac{\cos(c+dx)}{b(a+bx)}\right)}{2b}-\frac{\sin(c+dx)}{2b(a+bx)^2}$$

$$\Big\downarrow \text{3783}$$

$$\frac{d\left(-\frac{d\left(\frac{\sin\left(c-\frac{ad}{b}\right)\text{CosIntegral}\left(xd+\frac{ad}{b}\right)}{b}+\frac{\cos\left(c-\frac{ad}{b}\right)\text{Si}\left(xd+\frac{ad}{b}\right)}{b}\right)}{b}-\frac{\cos(c+dx)}{b(a+bx)}\right)}{2b}-\frac{\sin(c+dx)}{2b(a+bx)^2}$$

input
```
Int[Sin[c + d*x]/(a + b*x)^3,x]
```

output
```
-1/2*Sin[c + d*x]/(b*(a + b*x)^2) + (d*(-(Cos[c + d*x]/(b*(a + b*x))) - (d
*((CosIntegral[(a*d)/b + d*x]*Sin[c - (a*d)/b])/b + (Cos[c - (a*d)/b]*SinI
ntegral[(a*d)/b + d*x])/b))/b))/(2*b)
```

### 3.36.3.1 Defintions of rubi rules used

rule 25
```
Int[-(Fx_), x_Symbol] :> Simp[Identity[-1]   Int[Fx, x], x]
```

rule 3042
```
Int[u_, x_Symbol] :> Int[DeactivateTrig[u, x], x] /; FunctionOfTrigOfLinear
Q[u, x]
```

rule 3778
```
Int[((c_.) + (d_.)*(x_))^(m_)*sin[(e_.) + (f_.)*(x_)], x_Symbol] :> Simp[(c
 + d*x)^(m + 1)*(Sin[e + f*x]/(d*(m + 1))), x] - Simp[f/(d*(m + 1))   Int[(
c + d*x)^(m + 1)*Cos[e + f*x], x], x] /; FreeQ[{c, d, e, f}, x] && LtQ[m, -
1]
```

rule 3780
```
Int[sin[(e_.) + (f_.)*(x_)]/((c_.) + (d_.)*(x_)), x_Symbol] :> Simp[SinInte
gral[e + f*x]/d, x] /; FreeQ[{c, d, e, f}, x] && EqQ[d*e - c*f, 0]
```

rule 3783
```
Int[sin[(e_.) + (f_.)*(x_)]/((c_.) + (d_.)*(x_)), x_Symbol] :> Simp[CosInte
gral[e - Pi/2 + f*x]/d, x] /; FreeQ[{c, d, e, f}, x] && EqQ[d*(e - Pi/2) -
c*f, 0]
```

rule 3784
```
Int[sin[(e_.) + (f_.)*(x_)]/((c_.) + (d_.)*(x_)), x_Symbol] :> Simp[Cos[(d*
e - c*f)/d]   Int[Sin[c*(f/d) + f*x]/(c + d*x), x], x] + Simp[Sin[(d*e - c*
f)/d]   Int[Cos[c*(f/d) + f*x]/(c + d*x), x], x] /; FreeQ[{c, d, e, f}, x]
&& NeQ[d*e - c*f, 0]
```

### 3.36.4 Maple [A] (verified)

Time = 0.32 (sec) , antiderivative size = 145, normalized size of antiderivative = 1.39

| method | result |
|---|---|
| derivativedivides | $d^2\left(-\frac{\sin(dx+c)}{2(da-cb+b(dx+c))^2 b}+\frac{-\frac{\cos(dx+c)}{(da-cb+b(dx+c))b}-\frac{\frac{\mathrm{Si}\left(dx+c+\frac{da-cb}{b}\right)\cos\left(\frac{da-cb}{b}\right)}{b}-\frac{\mathrm{Ci}\left(dx+c+\frac{da-cb}{b}\right)\sin\left(\frac{da-cb}{b}\right)}{b}}{b}}{2b}\right)$ |
| default | $d^2\left(-\frac{\sin(dx+c)}{2(da-cb+b(dx+c))^2 b}+\frac{-\frac{\cos(dx+c)}{(da-cb+b(dx+c))b}-\frac{\frac{\mathrm{Si}\left(dx+c+\frac{da-cb}{b}\right)\cos\left(\frac{da-cb}{b}\right)}{b}-\frac{\mathrm{Ci}\left(dx+c+\frac{da-cb}{b}\right)\sin\left(\frac{da-cb}{b}\right)}{b}}{b}}{2b}\right)$ |
| risch | $-\frac{i d^2 \mathrm{e}^{-\frac{i(da-cb)}{b}} \mathrm{Ei}_1\left(-idx-ic-\frac{iad-icb}{b}\right)}{4b^3}+\frac{i d^2 \mathrm{e}^{\frac{i(da-cb)}{b}} \mathrm{Ei}_1\left(idx+ic+\frac{i(da-cb)}{b}\right)}{4b^3}+\frac{i(-2ib^3d^3x^3-6ia\,b^2d^3x^2-6ia}{4b^2(bx+a)^2(-d^2x^2b^2}$ |

input
```
int(sin(d*x+c)/(b*x+a)^3,x,method=_RETURNVERBOSE)
```

output
```
d^2*(-1/2*sin(d*x+c)/(d*a-c*b+b*(d*x+c))^2/b+1/2*(-cos(d*x+c)/(d*a-c*b+b*(
d*x+c))/b-(Si(d*x+c+(a*d-b*c)/b)*cos((a*d-b*c)/b)/b-Ci(d*x+c+(a*d-b*c)/b)*
sin((a*d-b*c)/b)/b)/b)/b)
```

### 3.36.5 Fricas [A] (verification not implemented)

Time = 0.29 (sec) , antiderivative size = 164, normalized size of antiderivative = 1.58

$$\int \frac{\sin(c+dx)}{(a+bx)^3}\,dx = -\frac{b^2\sin(dx+c) - (b^2d^2x^2 + 2\,abd^2x + a^2d^2)\,\mathrm{Ci}\left(\frac{bdx+ad}{b}\right)\sin\left(-\frac{bc-ad}{b}\right) + (b^2d^2x^2 + 2\,abd^2x + a^2d^2)\cos\left(-\right.}{2\,(b^5x^2 + 2\,ab^4x + a^2b^3)}$$

input
```
integrate(sin(d*x+c)/(b*x+a)^3,x, algorithm="fricas")
```

output
```
-1/2*(b^2*sin(d*x + c) - (b^2*d^2*x^2 + 2*a*b*d^2*x + a^2*d^2)*cos_integra
l((b*d*x + a*d)/b)*sin(-(b*c - a*d)/b) + (b^2*d^2*x^2 + 2*a*b*d^2*x + a^2*
d^2)*cos(-(b*c - a*d)/b)*sin_integral((b*d*x + a*d)/b) + (b^2*d*x + a*b*d)
*cos(d*x + c))/(b^5*x^2 + 2*a*b^4*x + a^2*b^3)
```

### 3.36.6 Sympy [F]

$$\int \frac{\sin(c+dx)}{(a+bx)^3}\,dx = \int \frac{\sin(c+dx)}{(a+bx)^3}\,dx$$

input
```
integrate(sin(d*x+c)/(b*x+a)**3,x)
```

output
```
Integral(sin(c + d*x)/(a + b*x)**3, x)
```

### 3.36.7 Maxima [C] (verification not implemented)

Result contains complex when optimal does not.

Time = 0.29 (sec) , antiderivative size = 199, normalized size of antiderivative = 1.91

$$\int \frac{\sin(c+dx)}{(a+bx)^3}\,dx = \frac{d^3\left(-i\,E_3\left(\frac{i\,(dx+c)b-i\,bc+i\,ad}{b}\right) + i\,E_3\left(-\frac{i\,(dx+c)b-i\,bc+i\,ad}{b}\right)\right)\cos\left(-\frac{bc-ad}{b}\right) + d^3\left(E_3\left(\frac{i\,(dx+c)b-i\,bc+i\,ad}{b}\right) + E_3\left(-\right.\right.}{2\left((dx+c)^2b^3 + b^3c^2 - 2\,ab^2cd + a^2bd^2 - 2\,(b^3c - ab^2d)(dx+c)\right)d}$$

input
```
integrate(sin(d*x+c)/(b*x+a)^3,x, algorithm="maxima")
```

output
```
1/2*(d^3*(-I*exp_integral_e(3, (I*(d*x + c)*b - I*b*c + I*a*d)/b) + I*exp_
integral_e(3, -(I*(d*x + c)*b - I*b*c + I*a*d)/b))*cos(-(b*c - a*d)/b) + d
^3*(exp_integral_e(3, (I*(d*x + c)*b - I*b*c + I*a*d)/b) + exp_integral_e(
3, -(I*(d*x + c)*b - I*b*c + I*a*d)/b))*sin(-(b*c - a*d)/b))/(((d*x + c)^2
*b^3 + b^3*c^2 - 2*a*b^2*c*d + a^2*b*d^2 - 2*(b^3*c - a*b^2*d)*(d*x + c))*
d)
```

### 3.36.8 Giac [C] (verification not implemented)

Result contains higher order function than in optimal. Order 9 vs. order 4.

Time = 0.41 (sec) , antiderivative size = 5727, normalized size of antiderivative = 55.07

$$\int \frac{\sin(c+dx)}{(a+bx)^3}\, dx = \text{Too large to display}$$

input
```
integrate(sin(d*x+c)/(b*x+a)^3,x, algorithm="giac")
```

output
```
-1/4*(b^2*d^2*x^2*imag_part(cos_integral(d*x + a*d/b))*tan(1/2*d*x)^2*tan(
1/2*c)^2*tan(1/2*a*d/b)^2 - b^2*d^2*x^2*imag_part(cos_integral(-d*x - a*d/
b))*tan(1/2*d*x)^2*tan(1/2*c)^2*tan(1/2*a*d/b)^2 + 2*b^2*d^2*x^2*sin_integ
ral((b*d*x + a*d)/b)*tan(1/2*d*x)^2*tan(1/2*c)^2*tan(1/2*a*d/b)^2 + 2*b^2*
d^2*x^2*real_part(cos_integral(d*x + a*d/b))*tan(1/2*d*x)^2*tan(1/2*c)^2*t
an(1/2*a*d/b) + 2*b^2*d^2*x^2*real_part(cos_integral(-d*x - a*d/b))*tan(1/
2*d*x)^2*tan(1/2*c)^2*tan(1/2*a*d/b) - 2*b^2*d^2*x^2*real_part(cos_integra
l(d*x + a*d/b))*tan(1/2*d*x)^2*tan(1/2*c)*tan(1/2*a*d/b)^2 - 2*b^2*d^2*x^2
*real_part(cos_integral(-d*x - a*d/b))*tan(1/2*d*x)^2*tan(1/2*c)*tan(1/2*a
*d/b)^2 + 2*a*b*d^2*x*imag_part(cos_integral(d*x + a*d/b))*tan(1/2*d*x)^2*
tan(1/2*c)^2*tan(1/2*a*d/b)^2 - 2*a*b*d^2*x*imag_part(cos_integral(-d*x -
a*d/b))*tan(1/2*d*x)^2*tan(1/2*c)^2*tan(1/2*a*d/b)^2 + 4*a*b*d^2*x*sin_int
egral((b*d*x + a*d)/b)*tan(1/2*d*x)^2*tan(1/2*c)^2*tan(1/2*a*d/b)^2 - b^2*
d^2*x^2*imag_part(cos_integral(d*x + a*d/b))*tan(1/2*d*x)^2*tan(1/2*c)^2 +
 b^2*d^2*x^2*imag_part(cos_integral(-d*x - a*d/b))*tan(1/2*d*x)^2*tan(1/2*
c)^2 - 2*b^2*d^2*x^2*sin_integral((b*d*x + a*d)/b)*tan(1/2*d*x)^2*tan(1/2*
c)^2 + 4*b^2*d^2*x^2*imag_part(cos_integral(d*x + a*d/b))*tan(1/2*d*x)^2*t
an(1/2*c)*tan(1/2*a*d/b) - 4*b^2*d^2*x^2*imag_part(cos_integral(-d*x - a*d
/b))*tan(1/2*d*x)^2*tan(1/2*c)*tan(1/2*a*d/b) + 8*b^2*d^2*x^2*sin_integral
((b*d*x + a*d)/b)*tan(1/2*d*x)^2*tan(1/2*c)*tan(1/2*a*d/b) + 4*a*b*d^2*...
```

### 3.36.9 Mupad [F(-1)]

Timed out.

$$\int \frac{\sin(c+dx)}{(a+bx)^3} dx = \int \frac{\sin(c+dx)}{(a+bx)^3} dx$$

input
```
int(sin(c + d*x)/(a + b*x)^3,x)
```

output
```
int(sin(c + d*x)/(a + b*x)^3, x)
```

# 3.37 $\int \frac{\sin(c+dx)}{x(a+bx)^3}\,dx$



## 3.37.1 Optimal result

Integrand size = 17, antiderivative size = 261

$$\begin{aligned}\int \frac{\sin(c+dx)}{x(a+bx)^3}\,dx =& \frac{d\cos(c+dx)}{2ab(a+bx)} - \frac{d\cos\left(c-\frac{ad}{b}\right)\text{CosIntegral}\left(\frac{ad}{b}+dx\right)}{a^2b} \\ &+ \frac{\text{CosIntegral}(dx)\sin(c)}{a^3} - \frac{\text{CosIntegral}\left(\frac{ad}{b}+dx\right)\sin\left(c-\frac{ad}{b}\right)}{a^3} \\ &+ \frac{d^2\,\text{CosIntegral}\left(\frac{ad}{b}+dx\right)\sin\left(c-\frac{ad}{b}\right)}{2ab^2} + \frac{\sin(c+dx)}{2a(a+bx)^2} \\ &+ \frac{\sin(c+dx)}{a^2(a+bx)} + \frac{\cos(c)\text{Si}(dx)}{a^3} - \frac{\cos\left(c-\frac{ad}{b}\right)\text{Si}\left(\frac{ad}{b}+dx\right)}{a^3} \\ &+ \frac{d^2\cos\left(c-\frac{ad}{b}\right)\text{Si}\left(\frac{ad}{b}+dx\right)}{2ab^2} + \frac{d\sin\left(c-\frac{ad}{b}\right)\text{Si}\left(\frac{ad}{b}+dx\right)}{a^2b}\end{aligned}$$

output
```
-d*Ci(a*d/b+d*x)*cos(-c+a*d/b)/a^2/b+1/2*d*cos(d*x+c)/a/b/(b*x+a)+cos(c)*S
i(d*x)/a^3-cos(-c+a*d/b)*Si(a*d/b+d*x)/a^3+1/2*d^2*cos(-c+a*d/b)*Si(a*d/b+
d*x)/a/b^2+Ci(d*x)*sin(c)/a^3+Ci(a*d/b+d*x)*sin(-c+a*d/b)/a^3-1/2*d^2*Ci(a
*d/b+d*x)*sin(-c+a*d/b)/a/b^2-d*Si(a*d/b+d*x)*sin(-c+a*d/b)/a^2/b+1/2*sin(
d*x+c)/a/(b*x+a)^2+sin(d*x+c)/a^2/(b*x+a)
```

### 3.37.2 Mathematica [A] (verified)

Time = 0.65 (sec) , antiderivative size = 449, normalized size of antiderivative = 1.72

$$\int \frac{\sin(c+dx)}{x(a+bx)^3}\,dx$$
$$= \frac{a^3bd\cos(c+dx)+a^2b^2dx\cos(c+dx)+2b^2(a+bx)^2\operatorname{CosIntegral}(dx)\sin(c)+(a+bx)^2\operatorname{CosIntegral}\left(d\left(\frac{a}{b}\right.\right.}{}$$

input
```
Integrate[Sin[c + d*x]/(x*(a + b*x)^3),x]
```

output
```
(a^3*b*d*Cos[c + d*x] + a^2*b^2*d*x*Cos[c + d*x] + 2*b^2*(a + b*x)^2*CosIn
tegral[d*x]*Sin[c] + (a + b*x)^2*CosIntegral[d*(a/b + x)]*(-2*a*b*d*Cos[c
- (a*d)/b] + (-2*b^2 + a^2*d^2)*Sin[c - (a*d)/b]) + 3*a^2*b^2*Sin[c + d*x]
 + 2*a*b^3*x*Sin[c + d*x] + 2*a^2*b^2*Cos[c]*SinIntegral[d*x] + 4*a*b^3*x*
Cos[c]*SinIntegral[d*x] + 2*b^4*x^2*Cos[c]*SinIntegral[d*x] - 2*a^2*b^2*Co
s[c - (a*d)/b]*SinIntegral[d*(a/b + x)] + a^4*d^2*Cos[c - (a*d)/b]*SinInte
gral[d*(a/b + x)] - 4*a*b^3*x*Cos[c - (a*d)/b]*SinIntegral[d*(a/b + x)] +
2*a^3*b*d^2*x*Cos[c - (a*d)/b]*SinIntegral[d*(a/b + x)] - 2*b^4*x^2*Cos[c
- (a*d)/b]*SinIntegral[d*(a/b + x)] + a^2*b^2*d^2*x^2*Cos[c - (a*d)/b]*Sin
Integral[d*(a/b + x)] + 2*a^3*b*d*Sin[c - (a*d)/b]*SinIntegral[d*(a/b + x)
] + 4*a^2*b^2*d*x*Sin[c - (a*d)/b]*SinIntegral[d*(a/b + x)] + 2*a*b^3*d*x^
2*Sin[c - (a*d)/b]*SinIntegral[d*(a/b + x)])/(2*a^3*b^2*(a + b*x)^2)
```

### 3.37.3 Rubi [A] (verified)

Time = 0.77 (sec) , antiderivative size = 261, normalized size of antiderivative = 1.00, number of steps used = 2, number of rules used = 2, $\frac{\text{number of rules}}{\text{integrand size}}$ = 0.118, Rules used = {7293, 2009}

Below are the steps used by Rubi to obtain the solution. The rule number used for the transformation is given above next to the arrow. The rules definitions used are listed below.

$$\int \frac{\sin(c+dx)}{x(a+bx)^3}\,dx$$
$$\Big\downarrow \ 7293$$
$$\int \left(-\frac{b\sin(c+dx)}{a^3(a+bx)}+\frac{\sin(c+dx)}{a^3x}-\frac{b\sin(c+dx)}{a^2(a+bx)^2}-\frac{b\sin(c+dx)}{a(a+bx)^3}\right)dx$$
$$\Big\downarrow \ 2009$$

$$-\frac{\sin\left(c-\frac{ad}{b}\right)\text{CosIntegral}\left(xd+\frac{ad}{b}\right)}{a^3}-\frac{\cos\left(c-\frac{ad}{b}\right)\text{Si}\left(xd+\frac{ad}{b}\right)}{a^3}+\frac{\sin(c)\,\text{CosIntegral}(dx)}{a^3}+\frac{\cos(c)\text{Si}(dx)}{a^3}-\frac{d\cos\left(c-\frac{ad}{b}\right)\text{CosIntegral}\left(xd+\frac{ad}{b}\right)}{a^2b}+\frac{d\sin\left(c-\frac{ad}{b}\right)\text{Si}\left(xd+\frac{ad}{b}\right)}{a^2b}+\frac{\sin(c+dx)}{a^2(a+bx)}+\frac{d^2\sin\left(c-\frac{ad}{b}\right)\text{CosIntegral}\left(xd+\frac{ad}{b}\right)}{2ab^2}+\frac{d^2\cos\left(c-\frac{ad}{b}\right)\text{Si}\left(xd+\frac{ad}{b}\right)}{2ab^2}+\frac{\sin(c+dx)}{2a(a+bx)^2}+\frac{d\cos(c+dx)}{2ab(a+bx)}$$

input
```
Int[Sin[c + d*x]/(x*(a + b*x)^3),x]
```

output
```
(d*Cos[c + d*x])/(2*a*b*(a + b*x)) - (d*Cos[c - (a*d)/b]*CosIntegral[(a*d)
/b + d*x])/(a^2*b) + (CosIntegral[d*x]*Sin[c])/a^3 - (CosIntegral[(a*d)/b
+ d*x]*Sin[c - (a*d)/b])/a^3 + (d^2*CosIntegral[(a*d)/b + d*x]*Sin[c - (a*
d)/b])/(2*a*b^2) + Sin[c + d*x]/(2*a*(a + b*x)^2) + Sin[c + d*x]/(a^2*(a +
 b*x)) + (Cos[c]*SinIntegral[d*x])/a^3 - (Cos[c - (a*d)/b]*SinIntegral[(a*
d)/b + d*x])/a^3 + (d^2*Cos[c - (a*d)/b]*SinIntegral[(a*d)/b + d*x])/(2*a*
b^2) + (d*Sin[c - (a*d)/b]*SinIntegral[(a*d)/b + d*x])/(a^2*b)
```

### 3.37.3.1 Defintions of rubi rules used

rule 2009
```
Int[u_, x_Symbol] :> Simp[IntSum[u, x], x] /; SumQ[u]
```

rule 7293
```
Int[u_, x_Symbol] :> With[{v = ExpandIntegrand[u, x]}, Int[v, x] /; SumQ[v]
]
```

### 3.37.4 Maple [A] (verified)

Time = 0.37 (sec) , antiderivative size = 359, normalized size of antiderivative = 1.38

| method | result |
|---|---|
| derivativedivides | $\frac{\mathrm{Si}(dx)\cos(c)+\mathrm{Ci}(dx)\sin(c)}{a^3} - \frac{db\left(-\frac{\sin(dx+c)}{(da-cb+b(dx+c))b} + \frac{\mathrm{Si}\left(dx+c+\frac{da-cb}{b}\right)\sin\left(\frac{da-cb}{b}\right)}{b} + \frac{\mathrm{Ci}\left(dx+c+\frac{da-cb}{b}\right)\cos\left(\frac{da-cb}{b}\right)}{b}\right.}{a^2}$ |
| default | $\frac{\mathrm{Si}(dx)\cos(c)+\mathrm{Ci}(dx)\sin(c)}{a^3} - \frac{db\left(-\frac{\sin(dx+c)}{(da-cb+b(dx+c))b} + \frac{\mathrm{Si}\left(dx+c+\frac{da-cb}{b}\right)\sin\left(\frac{da-cb}{b}\right)}{b} + \frac{\mathrm{Ci}\left(dx+c+\frac{da-cb}{b}\right)\cos\left(\frac{da-cb}{b}\right)}{b}\right.}{a^2}$ |
| risch | $-\frac{i\mathrm{e}^{-ic}\,\mathrm{Ei}_1(-idx)}{2a^3} + \frac{d\,\mathrm{e}^{-\frac{i(da-cb)}{b}}\,\mathrm{Ei}_1\left(-idx-ic-\frac{iad-icb}{b}\right)}{2b\,a^2} - \frac{i\mathrm{e}^{-\frac{i(da-cb)}{b}}\,\mathrm{Ei}_1\left(-idx-ic-\frac{iad-icb}{b}\right)}{2a^3} - \frac{i\mathrm{e}^{\frac{i(da-cb)}{b}}}{}$ |

input
```
int(sin(d*x+c)/x/(b*x+a)^3,x,method=_RETURNVERBOSE)
```

output
```
1/a^3*(Si(d*x)*cos(c)+Ci(d*x)*sin(c))-d*b/a^2*(-sin(d*x+c)/(d*a-c*b+b*(d*x
+c))/b+(Si(d*x+c+(a*d-b*c)/b)*sin((a*d-b*c)/b)/b+Ci(d*x+c+(a*d-b*c)/b)*cos
((a*d-b*c)/b)/b)/b)-d^2*b/a*(-1/2*sin(d*x+c)/(d*a-c*b+b*(d*x+c))^2/b+1/2*(
-cos(d*x+c)/(d*a-c*b+b*(d*x+c))/b-(Si(d*x+c+(a*d-b*c)/b)*cos((a*d-b*c)/b)/
b-Ci(d*x+c+(a*d-b*c)/b)*sin((a*d-b*c)/b)/b)/b)/b)-b/a^3*(Si(d*x+c+(a*d-b*c
)/b)*cos((a*d-b*c)/b)/b-Ci(d*x+c+(a*d-b*c)/b)*sin((a*d-b*c)/b)/b)
```

### 3.37.5 Fricas [A] (verification not implemented)

Time = 0.32 (sec) , antiderivative size = 391, normalized size of antiderivative = 1.50

$$\int \frac{\sin(c+dx)}{x(a+bx)^3}\,dx$$
$$= \frac{2\left(b^4x^2+2\,ab^3x+a^2b^2\right)\mathrm{Ci}\left(dx\right)\sin\left(c\right)+2\left(b^4x^2+2\,ab^3x+a^2b^2\right)\cos\left(c\right)\mathrm{Si}\left(dx\right)+\left(a^2b^2dx+a^3bd\right)\cos\left(dx\right.}{}$$

input
```
integrate(sin(d*x+c)/x/(b*x+a)^3,x, algorithm="fricas")
```

output
```
1/2*(2*(b^4*x^2 + 2*a*b^3*x + a^2*b^2)*cos_integral(d*x)*sin(c) + 2*(b^4*x
^2 + 2*a*b^3*x + a^2*b^2)*cos(c)*sin_integral(d*x) + (a^2*b^2*d*x + a^3*b*
d)*cos(d*x + c) - (2*(a*b^3*d*x^2 + 2*a^2*b^2*d*x + a^3*b*d)*cos_integral(
(b*d*x + a*d)/b) - (a^4*d^2 - 2*a^2*b^2 + (a^2*b^2*d^2 - 2*b^4)*x^2 + 2*(a
^3*b*d^2 - 2*a*b^3)*x)*sin_integral((b*d*x + a*d)/b))*cos(-(b*c - a*d)/b)
+ (2*a*b^3*x + 3*a^2*b^2)*sin(d*x + c) - ((a^4*d^2 - 2*a^2*b^2 + (a^2*b^2*
d^2 - 2*b^4)*x^2 + 2*(a^3*b*d^2 - 2*a*b^3)*x)*cos_integral((b*d*x + a*d)/b
) + 2*(a*b^3*d*x^2 + 2*a^2*b^2*d*x + a^3*b*d)*sin_integral((b*d*x + a*d)/b
))*sin(-(b*c - a*d)/b))/(a^3*b^4*x^2 + 2*a^4*b^3*x + a^5*b^2)
```

## 3.37.6 Sympy [F]

$$\int \frac{\sin(c+dx)}{x(a+bx)^3}\,dx = \int \frac{\sin{(c+dx)}}{x\,(a+bx)^3}\,dx$$

input
```
integrate(sin(d*x+c)/x/(b*x+a)**3,x)
```

output
```
Integral(sin(c + d*x)/(x*(a + b*x)**3), x)
```

## 3.37.7 Maxima [F]

$$\int \frac{\sin(c+dx)}{x(a+bx)^3}\,dx = \int \frac{\sin{(dx+c)}}{(bx+a)^3x}\,dx$$

input
```
integrate(sin(d*x+c)/x/(b*x+a)^3,x, algorithm="maxima")
```

output
```
integrate(sin(d*x + c)/((b*x + a)^3*x), x)
```

### 3.37.8 Giac [C] (verification not implemented)

Result contains higher order function than in optimal. Order 9 vs. order 4.

Time = 0.67 (sec) , antiderivative size = 17806, normalized size of antiderivative = 68.22

$$\int \frac{\sin(c+dx)}{x(a+bx)^3} dx = \text{Too large to display}$$

input
```
integrate(sin(d*x+c)/x/(b*x+a)^3,x, algorithm="giac")
```

output
```
1/4*(a^2*b^2*d^2*x^2*imag_part(cos_integral(d*x + a*d/b))*tan(1/2*d*x)^2*t
an(1/2*c)^2*tan(1/2*a*d/b)^2 - a^2*b^2*d^2*x^2*imag_part(cos_integral(-d*x
 - a*d/b))*tan(1/2*d*x)^2*tan(1/2*c)^2*tan(1/2*a*d/b)^2 + 2*a^2*b^2*d^2*x^
2*sin_integral((b*d*x + a*d)/b)*tan(1/2*d*x)^2*tan(1/2*c)^2*tan(1/2*a*d/b)
^2 + 2*a^2*b^2*d^2*x^2*real_part(cos_integral(d*x + a*d/b))*tan(1/2*d*x)^2
*tan(1/2*c)^2*tan(1/2*a*d/b) + 2*a^2*b^2*d^2*x^2*real_part(cos_integral(-d
*x - a*d/b))*tan(1/2*d*x)^2*tan(1/2*c)^2*tan(1/2*a*d/b) - 2*a^2*b^2*d^2*x^
2*real_part(cos_integral(d*x + a*d/b))*tan(1/2*d*x)^2*tan(1/2*c)*tan(1/2*a
*d/b)^2 - 2*a^2*b^2*d^2*x^2*real_part(cos_integral(-d*x - a*d/b))*tan(1/2*
d*x)^2*tan(1/2*c)*tan(1/2*a*d/b)^2 + 2*a^3*b*d^2*x*imag_part(cos_integral(
d*x + a*d/b))*tan(1/2*d*x)^2*tan(1/2*c)^2*tan(1/2*a*d/b)^2 - 2*a^3*b*d^2*x
*imag_part(cos_integral(-d*x - a*d/b))*tan(1/2*d*x)^2*tan(1/2*c)^2*tan(1/2
*a*d/b)^2 - 2*a*b^3*d*x^2*real_part(cos_integral(d*x + a*d/b))*tan(1/2*d*x
)^2*tan(1/2*c)^2*tan(1/2*a*d/b)^2 - 2*a*b^3*d*x^2*real_part(cos_integral(-
d*x - a*d/b))*tan(1/2*d*x)^2*tan(1/2*c)^2*tan(1/2*a*d/b)^2 + 4*a^3*b*d^2*x
*sin_integral((b*d*x + a*d)/b)*tan(1/2*d*x)^2*tan(1/2*c)^2*tan(1/2*a*d/b)^
2 - a^2*b^2*d^2*x^2*imag_part(cos_integral(d*x + a*d/b))*tan(1/2*d*x)^2*ta
n(1/2*c)^2 + a^2*b^2*d^2*x^2*imag_part(cos_integral(-d*x - a*d/b))*tan(1/2
*d*x)^2*tan(1/2*c)^2 - 2*a^2*b^2*d^2*x^2*sin_integral((b*d*x + a*d)/b)*tan
(1/2*d*x)^2*tan(1/2*c)^2 + 4*a^2*b^2*d^2*x^2*imag_part(cos_integral(d*x...
```

### 3.37.9 Mupad [F(-1)]

Timed out.

$$\int \frac{\sin(c+dx)}{x(a+bx)^3} dx = \int \frac{\sin(c+d\,x)}{x\,(a+b\,x)^3} \,dx$$

input
```
int(sin(c + d*x)/(x*(a + b*x)^3),x)
```

output
```
int(sin(c + d*x)/(x*(a + b*x)^3), x)
```

# 3.38 $\int \frac{\sin(c+dx)}{x^2(a+bx)^3}\,dx$



## 3.38.1 Optimal result

Integrand size = 17, antiderivative size = 299

$$\begin{aligned}\int \frac{\sin(c+dx)}{x^2(a+bx)^3}\,dx &= -\frac{d\cos(c+dx)}{2a^2(a+bx)}+\frac{d\cos(c)\,\text{CosIntegral}(dx)}{a^3}\\&\quad+\frac{2d\cos\left(c-\frac{ad}{b}\right)\text{CosIntegral}\left(\frac{ad}{b}+dx\right)}{a^3}\\&\quad-\frac{3b\,\text{CosIntegral}(dx)\sin(c)}{a^4}+\frac{3b\,\text{CosIntegral}\left(\frac{ad}{b}+dx\right)\sin\left(c-\frac{ad}{b}\right)}{a^4}\\&\quad-\frac{d^2\,\text{CosIntegral}\left(\frac{ad}{b}+dx\right)\sin\left(c-\frac{ad}{b}\right)}{2a^2b}-\frac{\sin(c+dx)}{a^3x}\\&\quad-\frac{b\sin(c+dx)}{2a^2(a+bx)^2}-\frac{2b\sin(c+dx)}{a^3(a+bx)}-\frac{3b\cos(c)\text{Si}(dx)}{a^4}\\&\quad-\frac{d\sin(c)\text{Si}(dx)}{a^3}+\frac{3b\cos\left(c-\frac{ad}{b}\right)\text{Si}\left(\frac{ad}{b}+dx\right)}{a^4}\\&\quad-\frac{d^2\cos\left(c-\frac{ad}{b}\right)\text{Si}\left(\frac{ad}{b}+dx\right)}{2a^2b}-\frac{2d\sin\left(c-\frac{ad}{b}\right)\text{Si}\left(\frac{ad}{b}+dx\right)}{a^3}\end{aligned}$$

output
```
d*Ci(d*x)*cos(c)/a^3+2*d*Ci(a*d/b+d*x)*cos(-c+a*d/b)/a^3-1/2*d*cos(d*x+c)/
a^2/(b*x+a)-3*b*cos(c)*Si(d*x)/a^4+3*b*cos(-c+a*d/b)*Si(a*d/b+d*x)/a^4-1/2
*d^2*cos(-c+a*d/b)*Si(a*d/b+d*x)/a^2/b-3*b*Ci(d*x)*sin(c)/a^4-d*Si(d*x)*si
n(c)/a^3-3*b*Ci(a*d/b+d*x)*sin(-c+a*d/b)/a^4+1/2*d^2*Ci(a*d/b+d*x)*sin(-c+
a*d/b)/a^2/b+2*d*Si(a*d/b+d*x)*sin(-c+a*d/b)/a^3-sin(d*x+c)/a^3/x-1/2*b*si
n(d*x+c)/a^2/(b*x+a)^2-2*b*sin(d*x+c)/a^3/(b*x+a)
```

### 3.38.2 Mathematica [A] (verified)

Time = 1.19 (sec) , antiderivative size = 540, normalized size of antiderivative = 1.81

$$\int \frac{\sin(c+dx)}{x^2(a+bx)^3}\,dx = -\frac{a^3bdx\cos(c+dx)+a^2b^2dx^2\cos(c+dx)+2bx(a+bx)^2\operatorname{CosIntegral}(dx)(-ad\cos(c)+3b\sin(c))+x(a}{}$$

input
```
Integrate[Sin[c + d*x]/(x^2*(a + b*x)^3),x]
```

output
```
-1/2*(a^3*b*d*x*Cos[c + d*x] + a^2*b^2*d*x^2*Cos[c + d*x] + 2*b*x*(a + b*x
)^2*CosIntegral[d*x]*(-(a*d*Cos[c]) + 3*b*Sin[c]) + x*(a + b*x)^2*CosInteg
ral[d*(a/b + x)]*(-4*a*b*d*Cos[c - (a*d)/b] + (-6*b^2 + a^2*d^2)*Sin[c - (
a*d)/b]) + 2*a^3*b*Sin[c + d*x] + 9*a^2*b^2*x*Sin[c + d*x] + 6*a*b^3*x^2*S
in[c + d*x] + 6*a^2*b^2*x*Cos[c]*SinIntegral[d*x] + 12*a*b^3*x^2*Cos[c]*Si
nIntegral[d*x] + 6*b^4*x^3*Cos[c]*SinIntegral[d*x] + 2*a^3*b*d*x*Sin[c]*Si
nIntegral[d*x] + 4*a^2*b^2*d*x^2*Sin[c]*SinIntegral[d*x] + 2*a*b^3*d*x^3*S
in[c]*SinIntegral[d*x] - 6*a^2*b^2*x*Cos[c - (a*d)/b]*SinIntegral[d*(a/b +
 x)] + a^4*d^2*x*Cos[c - (a*d)/b]*SinIntegral[d*(a/b + x)] - 12*a*b^3*x^2*
Cos[c - (a*d)/b]*SinIntegral[d*(a/b + x)] + 2*a^3*b*d^2*x^2*Cos[c - (a*d)/
b]*SinIntegral[d*(a/b + x)] - 6*b^4*x^3*Cos[c - (a*d)/b]*SinIntegral[d*(a/
b + x)] + a^2*b^2*d^2*x^3*Cos[c - (a*d)/b]*SinIntegral[d*(a/b + x)] + 4*a^
3*b*d*x*Sin[c - (a*d)/b]*SinIntegral[d*(a/b + x)] + 8*a^2*b^2*d*x^2*Sin[c
- (a*d)/b]*SinIntegral[d*(a/b + x)] + 4*a*b^3*d*x^3*Sin[c - (a*d)/b]*SinIn
tegral[d*(a/b + x)])/(a^4*b*x*(a + b*x)^2)
```

### 3.38.3 Rubi [A] (verified)

Time = 0.87 (sec) , antiderivative size = 299, normalized size of antiderivative = 1.00, number of steps used = 2, number of rules used = 2, $\frac{\text{number of rules}}{\text{integrand size}}$ = 0.118, Rules used = {7293, 2009}

Below are the steps used by Rubi to obtain the solution. The rule number used for the transformation is given above next to the arrow. The rules definitions used are listed below.

$$\int \frac{\sin(c+dx)}{x^2(a+bx)^3}\,dx$$

$$\Big\downarrow \; 7293$$

$$\int \left(\frac{3b^2\sin(c+dx)}{a^4(a+bx)}-\frac{3b\sin(c+dx)}{a^4x}+\frac{2b^2\sin(c+dx)}{a^3(a+bx)^2}+\frac{\sin(c+dx)}{a^3x^2}+\frac{b^2\sin(c+dx)}{a^2(a+bx)^3}\right)dx$$

$$\Big\downarrow \text{ 2009}$$

$$-\frac{3b\sin(c)\,\text{CosIntegral}(dx)}{a^4}+\frac{3b\sin\left(c-\frac{ad}{b}\right)\text{CosIntegral}\left(xd+\frac{ad}{b}\right)}{a^4}-\frac{3b\cos(c)\text{Si}(dx)}{a^4}+\frac{3b\cos\left(c-\frac{ad}{b}\right)\text{Si}\left(xd+\frac{ad}{b}\right)}{a^4}+\frac{2d\cos\left(c-\frac{ad}{b}\right)\text{CosIntegral}\left(xd+\frac{ad}{b}\right)}{a^3}-\frac{2d\sin\left(c-\frac{ad}{b}\right)\text{Si}\left(xd+\frac{ad}{b}\right)}{a^3}-\frac{2b\sin(c+dx)}{a^3(a+bx)}+\frac{d\cos(c)\,\text{CosIntegral}(dx)}{a^3}-\frac{d\sin(c)\text{Si}(dx)}{a^3}-\frac{\sin(c+dx)}{a^3x}-\frac{d^2\sin\left(c-\frac{ad}{b}\right)\text{CosIntegral}\left(xd+\frac{ad}{b}\right)}{2a^2b}-\frac{d^2\cos\left(c-\frac{ad}{b}\right)\text{Si}\left(xd+\frac{ad}{b}\right)}{2a^2b}-\frac{b\sin(c+dx)}{2a^2(a+bx)^2}-\frac{d\cos(c+dx)}{2a^2(a+bx)}$$

input
```
Int[Sin[c + d*x]/(x^2*(a + b*x)^3),x]
```

output
```
-1/2*(d*Cos[c + d*x])/(a^2*(a + b*x)) + (d*Cos[c]*CosIntegral[d*x])/a^3 +
(2*d*Cos[c - (a*d)/b]*CosIntegral[(a*d)/b + d*x])/a^3 - (3*b*CosIntegral[d
*x]*Sin[c])/a^4 + (3*b*CosIntegral[(a*d)/b + d*x]*Sin[c - (a*d)/b])/a^4 -
(d^2*CosIntegral[(a*d)/b + d*x]*Sin[c - (a*d)/b])/(2*a^2*b) - Sin[c + d*x]
/(a^3*x) - (b*Sin[c + d*x])/(2*a^2*(a + b*x)^2) - (2*b*Sin[c + d*x])/(a^3*
(a + b*x)) - (3*b*Cos[c]*SinIntegral[d*x])/a^4 - (d*Sin[c]*SinIntegral[d*x
])/a^3 + (3*b*Cos[c - (a*d)/b]*SinIntegral[(a*d)/b + d*x])/a^4 - (d^2*Cos[
c - (a*d)/b]*SinIntegral[(a*d)/b + d*x])/(2*a^2*b) - (2*d*Sin[c - (a*d)/b]
*SinIntegral[(a*d)/b + d*x])/a^3
```

### 3.38.3.1 Defintions of rubi rules used

rule 2009
```
Int[u_, x_Symbol] :> Simp[IntSum[u, x], x] /; SumQ[u]
```

rule 7293
```
Int[u_, x_Symbol] :> With[{v = ExpandIntegrand[u, x]}, Int[v, x] /; SumQ[v]
]
```

### 3.38.4 Maple [A] (verified)

Time = 0.44 (sec) , antiderivative size = 405, normalized size of antiderivative = 1.35

| method | result |
|---|---|
| derivativedivides | $d\left(-\frac{3b(\mathrm{Si}(dx)\cos(c)+\mathrm{Ci}(dx)\sin(c))}{a^4d}+\frac{2b^2\left(-\frac{\sin(dx+c)}{(da-cb+b(dx+c))b}+\frac{\frac{\mathrm{Si}\left(dx+c+\frac{da-cb}{b}\right)\sin\left(\frac{da-cb}{b}\right)}{b}+\frac{\mathrm{Ci}\left(dx+c+\frac{da-cb}{b}\right)\mathrm{c}}{b}}{b}\right.}{a^3}\right.$ |
| default | $d\left(-\frac{3b(\mathrm{Si}(dx)\cos(c)+\mathrm{Ci}(dx)\sin(c))}{a^4d}+\frac{2b^2\left(-\frac{\sin(dx+c)}{(da-cb+b(dx+c))b}+\frac{\frac{\mathrm{Si}\left(dx+c+\frac{da-cb}{b}\right)\sin\left(\frac{da-cb}{b}\right)}{b}+\frac{\mathrm{Ci}\left(dx+c+\frac{da-cb}{b}\right)\mathrm{c}}{b}}{b}\right.}{a^3}\right.$ |
| risch | $-\frac{d\,\mathrm{e}^{-\frac{i(da-cb)}{b}}\,\mathrm{Ei}_1\left(-idx-ic-\frac{iad-icb}{b}\right)}{a^3}-\frac{3ib\,\mathrm{e}^{ic}\,\mathrm{Ei}_1(-idx)}{2a^4}+\frac{3ib\,\mathrm{e}^{-\frac{i(da-cb)}{b}}\,\mathrm{Ei}_1\left(-idx-ic-\frac{iad-icb}{b}\right)}{2a^4}-\frac{d\,\mathrm{e}^{ic}\,\mathrm{Ei}}{2a}$ |

input
```
int(sin(d*x+c)/x^2/(b*x+a)^3,x,method=_RETURNVERBOSE)
```

output
```
d*(-3/a^4/d*b*(Si(d*x)*cos(c)+Ci(d*x)*sin(c))+2*b^2/a^3*(-sin(d*x+c)/(d*a-
c*b+b*(d*x+c))/b+(Si(d*x+c+(a*d-b*c)/b)*sin((a*d-b*c)/b)/b+Ci(d*x+c+(a*d-b
*c)/b)*cos((a*d-b*c)/b)/b)/b)+d*b^2/a^2*(-1/2*sin(d*x+c)/(d*a-c*b+b*(d*x+c
))^2/b+1/2*(-cos(d*x+c)/(d*a-c*b+b*(d*x+c))/b-(Si(d*x+c+(a*d-b*c)/b)*cos((
a*d-b*c)/b)/b-Ci(d*x+c+(a*d-b*c)/b)*sin((a*d-b*c)/b)/b)/b)/b)+1/a^3*(-sin(
d*x+c)/d/x-Si(d*x)*sin(c)+Ci(d*x)*cos(c))+3/d*b^2/a^4*(Si(d*x+c+(a*d-b*c)/
b)*cos((a*d-b*c)/b)/b-Ci(d*x+c+(a*d-b*c)/b)*sin((a*d-b*c)/b)/b))
```

### 3.38.5 Fricas [A] (verification not implemented)

Time = 0.31 (sec) , antiderivative size = 500, normalized size of antiderivative = 1.67

$$\int \frac{\sin(c+dx)}{x^2(a+bx)^3}\,dx = -\frac{(a^2b^2dx^2+a^3bdx)\cos(dx+c)-2\left((ab^3dx^3+2\,a^2b^2dx^2+a^3bdx)\,\mathrm{Ci}\,(dx)-3\,(b^4x^3+2\,ab^3x^2+a^2b^2x)\,\mathrm{S}\right.}{}$$

input
```
integrate(sin(d*x+c)/x^2/(b*x+a)^3,x, algorithm="fricas")
```

output
```
-1/2*((a^2*b^2*d*x^2 + a^3*b*d*x)*cos(d*x + c) - 2*((a*b^3*d*x^3 + 2*a^2*b
^2*d*x^2 + a^3*b*d*x)*cos_integral(d*x) - 3*(b^4*x^3 + 2*a*b^3*x^2 + a^2*b
^2*x)*sin_integral(d*x))*cos(c) - (4*(a*b^3*d*x^3 + 2*a^2*b^2*d*x^2 + a^3*
b*d*x)*cos_integral((b*d*x + a*d)/b) - ((a^2*b^2*d^2 - 6*b^4)*x^3 + 2*(a^3
*b*d^2 - 6*a*b^3)*x^2 + (a^4*d^2 - 6*a^2*b^2)*x)*sin_integral((b*d*x + a*d
)/b))*cos(-(b*c - a*d)/b) + (6*a*b^3*x^2 + 9*a^2*b^2*x + 2*a^3*b)*sin(d*x
+ c) + 2*(3*(b^4*x^3 + 2*a*b^3*x^2 + a^2*b^2*x)*cos_integral(d*x) + (a*b^3
*d*x^3 + 2*a^2*b^2*d*x^2 + a^3*b*d*x)*sin_integral(d*x))*sin(c) - (((a^2*b
^2*d^2 - 6*b^4)*x^3 + 2*(a^3*b*d^2 - 6*a*b^3)*x^2 + (a^4*d^2 - 6*a^2*b^2)*
x)*cos_integral((b*d*x + a*d)/b) + 4*(a*b^3*d*x^3 + 2*a^2*b^2*d*x^2 + a^3*
b*d*x)*sin_integral((b*d*x + a*d)/b))*sin(-(b*c - a*d)/b))/(a^4*b^3*x^3 +
2*a^5*b^2*x^2 + a^6*b*x)
```

### 3.38.6 Sympy [F]

$$\int \frac{\sin(c+dx)}{x^2(a+bx)^3} \, dx = \int \frac{\sin{(c+dx)}}{x^2\,(a+bx)^3} \, dx$$

input
```
integrate(sin(d*x+c)/x**2/(b*x+a)**3,x)
```

output
```
Integral(sin(c + d*x)/(x**2*(a + b*x)**3), x)
```

### 3.38.7 Maxima [F]

$$\int \frac{\sin(c+dx)}{x^2(a+bx)^3} \, dx = \int \frac{\sin{(dx+c)}}{(bx+a)^3 x^2} \, dx$$

input
```
integrate(sin(d*x+c)/x^2/(b*x+a)^3,x, algorithm="maxima")
```

output
```
integrate(sin(d*x + c)/((b*x + a)^3*x^2), x)
```

### 3.38.8 Giac [C] (verification not implemented)

Result contains higher order function than in optimal. Order 9 vs. order 4.

Time = 0.71 (sec) , antiderivative size = 20808, normalized size of antiderivative = 69.59

$$\int \frac{\sin(c+dx)}{x^2(a+bx)^3}\,dx = \text{Too large to display}$$

input
```
integrate(sin(d*x+c)/x^2/(b*x+a)^3,x, algorithm="giac")
```

output
```
-1/4*(a^2*b^2*d^2*x^3*imag_part(cos_integral(d*x + a*d/b))*tan(1/2*d*x)^2*
tan(1/2*c)^2*tan(1/2*a*d/b)^2 - a^2*b^2*d^2*x^3*imag_part(cos_integral(-d*
x - a*d/b))*tan(1/2*d*x)^2*tan(1/2*c)^2*tan(1/2*a*d/b)^2 + 2*a^2*b^2*d^2*x
^3*sin_integral((b*d*x + a*d)/b)*tan(1/2*d*x)^2*tan(1/2*c)^2*tan(1/2*a*d/b
)^2 + 2*a^2*b^2*d^2*x^3*real_part(cos_integral(d*x + a*d/b))*tan(1/2*d*x)^
2*tan(1/2*c)^2*tan(1/2*a*d/b) + 2*a^2*b^2*d^2*x^3*real_part(cos_integral(-
d*x - a*d/b))*tan(1/2*d*x)^2*tan(1/2*c)^2*tan(1/2*a*d/b) - 2*a^2*b^2*d^2*x
^3*real_part(cos_integral(d*x + a*d/b))*tan(1/2*d*x)^2*tan(1/2*c)*tan(1/2*
a*d/b)^2 - 2*a^2*b^2*d^2*x^3*real_part(cos_integral(-d*x - a*d/b))*tan(1/2
*d*x)^2*tan(1/2*c)*tan(1/2*a*d/b)^2 + 2*a^3*b*d^2*x^2*imag_part(cos_integr
al(d*x + a*d/b))*tan(1/2*d*x)^2*tan(1/2*c)^2*tan(1/2*a*d/b)^2 - 2*a^3*b*d^
2*x^2*imag_part(cos_integral(-d*x - a*d/b))*tan(1/2*d*x)^2*tan(1/2*c)^2*ta
n(1/2*a*d/b)^2 - 4*a*b^3*d*x^3*real_part(cos_integral(d*x + a*d/b))*tan(1/
2*d*x)^2*tan(1/2*c)^2*tan(1/2*a*d/b)^2 + 2*a*b^3*d*x^3*real_part(cos_integ
ral(d*x))*tan(1/2*d*x)^2*tan(1/2*c)^2*tan(1/2*a*d/b)^2 - 4*a*b^3*d*x^3*rea
l_part(cos_integral(-d*x - a*d/b))*tan(1/2*d*x)^2*tan(1/2*c)^2*tan(1/2*a*d
/b)^2 + 2*a*b^3*d*x^3*real_part(cos_integral(-d*x))*tan(1/2*d*x)^2*tan(1/2
*c)^2*tan(1/2*a*d/b)^2 + 4*a^3*b*d^2*x^2*sin_integral((b*d*x + a*d)/b)*tan
(1/2*d*x)^2*tan(1/2*c)^2*tan(1/2*a*d/b)^2 - a^2*b^2*d^2*x^3*imag_part(cos_
integral(d*x + a*d/b))*tan(1/2*d*x)^2*tan(1/2*c)^2 + a^2*b^2*d^2*x^3*im...
```

### 3.38.9 Mupad [F(-1)]

Timed out.

$$\int \frac{\sin(c+dx)}{x^2(a+bx)^3}\,dx = \int \frac{\sin\left(c+d\,x\right)}{x^2\,{\left(a+b\,x\right)}^3}\,dx$$

input
```
int(sin(c + d*x)/(x^2*(a + b*x)^3),x)
```

output
```
int(sin(c + d*x)/(x^2*(a + b*x)^3), x)
```

# 3.39 $\int \frac{\sin(c+dx)}{x^3(a+bx)^3}\,dx$



## 3.39.1 Optimal result

Integrand size = 17, antiderivative size = 377

$$\begin{aligned}\int \frac{\sin(c+dx)}{x^3(a+bx)^3}\,dx =& -\frac{d\cos(c+dx)}{2a^3x}+\frac{bd\cos(c+dx)}{2a^3(a+bx)}-\frac{3bd\cos(c)\,\mathrm{CosIntegral}(dx)}{a^4} \\ & -\frac{3bd\cos\left(c-\frac{ad}{b}\right)\mathrm{CosIntegral}\left(\frac{ad}{b}+dx\right)}{a^4}+\frac{6b^2\,\mathrm{CosIntegral}(dx)\sin(c)}{a^5} \\ & -\frac{d^2\,\mathrm{CosIntegral}(dx)\sin(c)}{2a^3}-\frac{6b^2\,\mathrm{CosIntegral}\left(\frac{ad}{b}+dx\right)\sin\left(c-\frac{ad}{b}\right)}{a^5} \\ & +\frac{d^2\,\mathrm{CosIntegral}\left(\frac{ad}{b}+dx\right)\sin\left(c-\frac{ad}{b}\right)}{2a^3}-\frac{\sin(c+dx)}{2a^3x^2} \\ & +\frac{3b\sin(c+dx)}{a^4x}+\frac{b^2\sin(c+dx)}{2a^3(a+bx)^2}+\frac{3b^2\sin(c+dx)}{a^4(a+bx)}+\frac{6b^2\cos(c)\mathrm{Si}(dx)}{a^5} \\ & -\frac{d^2\cos(c)\mathrm{Si}(dx)}{2a^3}+\frac{3bd\sin(c)\mathrm{Si}(dx)}{a^4}-\frac{6b^2\cos\left(c-\frac{ad}{b}\right)\mathrm{Si}\left(\frac{ad}{b}+dx\right)}{a^5} \\ & +\frac{d^2\cos\left(c-\frac{ad}{b}\right)\mathrm{Si}\left(\frac{ad}{b}+dx\right)}{2a^3}+\frac{3bd\sin\left(c-\frac{ad}{b}\right)\mathrm{Si}\left(\frac{ad}{b}+dx\right)}{a^4}\end{aligned}$$

output
```
-3*b*d*Ci(d*x)*cos(c)/a^4-3*b*d*Ci(a*d/b+d*x)*cos(-c+a*d/b)/a^4-1/2*d*cos(
d*x+c)/a^3/x+1/2*b*d*cos(d*x+c)/a^3/(b*x+a)+6*b^2*cos(c)*Si(d*x)/a^5-1/2*d
^2*cos(c)*Si(d*x)/a^3-6*b^2*cos(-c+a*d/b)*Si(a*d/b+d*x)/a^5+1/2*d^2*cos(-c
+a*d/b)*Si(a*d/b+d*x)/a^3+6*b^2*Ci(d*x)*sin(c)/a^5-1/2*d^2*Ci(d*x)*sin(c)/
a^3+3*b*d*Si(d*x)*sin(c)/a^4+6*b^2*Ci(a*d/b+d*x)*sin(-c+a*d/b)/a^5-1/2*d^2
*Ci(a*d/b+d*x)*sin(-c+a*d/b)/a^3-3*b*d*Si(a*d/b+d*x)*sin(-c+a*d/b)/a^4-1/2
*sin(d*x+c)/a^3/x^2+3*b*sin(d*x+c)/a^4/x+1/2*b^2*sin(d*x+c)/a^3/(b*x+a)^2+
3*b^2*sin(d*x+c)/a^4/(b*x+a)
```

### 3.39.2 Mathematica [A] (verified)

Time = 1.24 (sec) , antiderivative size = 630, normalized size of antiderivative = 1.67

$$\int \frac{\sin(c+dx)}{x^3(a+bx)^3}\,dx$$
$$= \frac{-a^4dx\cos(c+dx)-a^3bdx^2\cos(c+dx)-x^2(a+bx)^2\,\text{CosIntegral}(dx)\,(6abd\cos(c)+(-12b^2+a^2d^2)\sin$$

input

```
Integrate[Sin[c + d*x]/(x^3*(a + b*x)^3),x]
```

output

```
(-(a^4*d*x*Cos[c + d*x]) - a^3*b*d*x^2*Cos[c + d*x] - x^2*(a + b*x)^2*CosI
ntegral[d*x]*(6*a*b*d*Cos[c] + (-12*b^2 + a^2*d^2)*Sin[c]) + x^2*(a + b*x)
^2*CosIntegral[d*(a/b + x)]*(-6*a*b*d*Cos[c - (a*d)/b] + (-12*b^2 + a^2*d^
2)*Sin[c - (a*d)/b]) - a^4*Sin[c + d*x] + 4*a^3*b*x*Sin[c + d*x] + 18*a^2*
b^2*x^2*Sin[c + d*x] + 12*a*b^3*x^3*Sin[c + d*x] + 12*a^2*b^2*x^2*Cos[c]*S
inIntegral[d*x] - a^4*d^2*x^2*Cos[c]*SinIntegral[d*x] + 24*a*b^3*x^3*Cos[c
]*SinIntegral[d*x] - 2*a^3*b*d^2*x^3*Cos[c]*SinIntegral[d*x] + 12*b^4*x^4*
Cos[c]*SinIntegral[d*x] - a^2*b^2*d^2*x^4*Cos[c]*SinIntegral[d*x] + 6*a^3*
b*d*x^2*Sin[c]*SinIntegral[d*x] + 12*a^2*b^2*d*x^3*Sin[c]*SinIntegral[d*x]
 + 6*a*b^3*d*x^4*Sin[c]*SinIntegral[d*x] - 12*a^2*b^2*x^2*Cos[c - (a*d)/b]
*SinIntegral[d*(a/b + x)] + a^4*d^2*x^2*Cos[c - (a*d)/b]*SinIntegral[d*(a/
b + x)] - 24*a*b^3*x^3*Cos[c - (a*d)/b]*SinIntegral[d*(a/b + x)] + 2*a^3*b
*d^2*x^3*Cos[c - (a*d)/b]*SinIntegral[d*(a/b + x)] - 12*b^4*x^4*Cos[c - (a
*d)/b]*SinIntegral[d*(a/b + x)] + a^2*b^2*d^2*x^4*Cos[c - (a*d)/b]*SinInte
gral[d*(a/b + x)] + 6*a^3*b*d*x^2*Sin[c - (a*d)/b]*SinIntegral[d*(a/b + x)
] + 12*a^2*b^2*d*x^3*Sin[c - (a*d)/b]*SinIntegral[d*(a/b + x)] + 6*a*b^3*d
*x^4*Sin[c - (a*d)/b]*SinIntegral[d*(a/b + x)])/(2*a^5*x^2*(a + b*x)^2)
```

### 3.39.3 Rubi [A] (verified)

Time = 1.02 (sec) , antiderivative size = 377, normalized size of antiderivative = 1.00, number of steps used = 2, number of rules used = 2, $\frac{\text{number of rules}}{\text{integrand size}} = 0.118$, Rules used = {7293, 2009}

Below are the steps used by Rubi to obtain the solution. The rule number used for the transformation is given above next to the arrow. The rules definitions used are listed below.

$$\int \frac{\sin(c+dx)}{x^3(a+bx)^3}\,dx$$

$$\Big\downarrow \text{7293}$$

$$\int \left(-\frac{6b^3\sin(c+dx)}{a^5(a+bx)}+\frac{6b^2\sin(c+dx)}{a^5x}-\frac{3b^3\sin(c+dx)}{a^4(a+bx)^2}-\frac{3b\sin(c+dx)}{a^4x^2}-\frac{b^3\sin(c+dx)}{a^3(a+bx)^3}+\frac{\sin(c+dx)}{a^3x^3}\right)dx$$

$$\Big\downarrow \text{2009}$$

$$\frac{6b^2\sin(c)\operatorname{CosIntegral}(dx)}{a^5}-\frac{6b^2\sin\left(c-\frac{ad}{b}\right)\operatorname{CosIntegral}\left(xd+\frac{ad}{b}\right)}{a^5}+\frac{6b^2\cos(c)\operatorname{Si}(dx)}{a^5}-\frac{6b^2\cos\left(c-\frac{ad}{b}\right)\operatorname{Si}\left(xd+\frac{ad}{b}\right)}{a^5}+\frac{3b^2\sin(c+dx)}{a^4(a+bx)}-\frac{3bd\cos(c)\operatorname{CosIntegral}(dx)}{a^4}-\frac{3bd\cos\left(c-\frac{ad}{b}\right)\operatorname{CosIntegral}\left(xd+\frac{ad}{b}\right)}{a^4}+\frac{3bd\sin(c)\operatorname{Si}(dx)}{a^4}+\frac{3bd\sin\left(c-\frac{ad}{b}\right)\operatorname{Si}\left(xd+\frac{ad}{b}\right)}{a^4}+\frac{3b\sin(c+dx)}{a^4x}+\frac{b^2\sin(c+dx)}{2a^3(a+bx)^2}+\frac{d^2\sin\left(c-\frac{ad}{b}\right)\operatorname{CosIntegral}\left(xd+\frac{ad}{b}\right)}{2a^3}+\frac{d^2\cos\left(c-\frac{ad}{b}\right)\operatorname{Si}\left(xd+\frac{ad}{b}\right)}{2a^3}+\frac{bd\cos(c+dx)}{2a^3(a+bx)}-\frac{d^2\sin(c)\operatorname{CosIntegral}(dx)}{2a^3}-\frac{d^2\cos(c)\operatorname{Si}(dx)}{2a^3}-\frac{\sin(c+dx)}{2a^3x^2}-\frac{d\cos(c+dx)}{2a^3x}$$

input
```
Int[Sin[c + d*x]/(x^3*(a + b*x)^3),x]
```

output
```
-1/2*(d*Cos[c + d*x])/(a^3*x) + (b*d*Cos[c + d*x])/(2*a^3*(a + b*x)) - (3*
b*d*Cos[c]*CosIntegral[d*x])/a^4 - (3*b*d*Cos[c - (a*d)/b]*CosIntegral[(a*
d)/b + d*x])/a^4 + (6*b^2*CosIntegral[d*x]*Sin[c])/a^5 - (d^2*CosIntegral[
d*x]*Sin[c])/(2*a^3) - (6*b^2*CosIntegral[(a*d)/b + d*x]*Sin[c - (a*d)/b])
/a^5 + (d^2*CosIntegral[(a*d)/b + d*x]*Sin[c - (a*d)/b])/(2*a^3) - Sin[c +
 d*x]/(2*a^3*x^2) + (3*b*Sin[c + d*x])/(a^4*x) + (b^2*Sin[c + d*x])/(2*a^3
*(a + b*x)^2) + (3*b^2*Sin[c + d*x])/(a^4*(a + b*x)) + (6*b^2*Cos[c]*SinIn
tegral[d*x])/a^5 - (d^2*Cos[c]*SinIntegral[d*x])/(2*a^3) + (3*b*d*Sin[c]*S
inIntegral[d*x])/a^4 - (6*b^2*Cos[c - (a*d)/b]*SinIntegral[(a*d)/b + d*x])
/a^5 + (d^2*Cos[c - (a*d)/b]*SinIntegral[(a*d)/b + d*x])/(2*a^3) + (3*b*d*
Sin[c - (a*d)/b]*SinIntegral[(a*d)/b + d*x])/a^4
```

## 3.39. $\int \frac{\sin(c+dx)}{x^3(a+bx)^3}\,dx$

### 3.39.3.1 Defintions of rubi rules used

rule 2009
```
Int[u_, x_Symbol] :> Simp[IntSum[u, x], x] /; SumQ[u]
```

rule 7293
```
Int[u_, x_Symbol] :> With[{v = ExpandIntegrand[u, x]}, Int[v, x] /; SumQ[v]
]
```

## 3.39.4 Maple [A] (verified)

Time = 0.54 (sec) , antiderivative size = 466, normalized size of antiderivative = 1.24

| method | result |
|---|---|
| derivativedivides | $d^2 \left( -\frac{3b^3 \left( -\frac{\sin(dx+c)}{(da-cb+b(dx+c))b} + \frac{\frac{\mathrm{Si}\left(dx+c+\frac{da-cb}{b}\right)\sin\left(\frac{da-cb}{b}\right)}{b} + \frac{\mathrm{Ci}\left(dx+c+\frac{da-cb}{b}\right)\cos\left(\frac{da-cb}{b}\right)}{b}}{b} \right)}{d\,a^4} - \frac{6b^3 \left( \frac{\mathrm{Si}\left(dx+c+\frac{da}{\ldots}\right.}{\ldots}\right.}{\ldots} \ldots \right.$ |
| default | $d^2 \left( -\frac{3b^3 \left( -\frac{\sin(dx+c)}{(da-cb+b(dx+c))b} + \frac{\frac{\mathrm{Si}\left(dx+c+\frac{da-cb}{b}\right)\sin\left(\frac{da-cb}{b}\right)}{b} + \frac{\mathrm{Ci}\left(dx+c+\frac{da-cb}{b}\right)\cos\left(\frac{da-cb}{b}\right)}{b}}{b} \right)}{d\,a^4} - \frac{6b^3 \left( \frac{\mathrm{Si}\left(dx+c+\frac{da}{\ldots}\right.}{\ldots}\right.}{\ldots} \ldots \right.$ |
| risch | $\frac{id^2 \mathrm{e}^{-\frac{i(da-cb)}{b}} \mathrm{Ei}_1\left(-idx-ic-\frac{iad-icb}{b}\right)}{4a^3} - \frac{id^2 \mathrm{e}^{ic} \mathrm{Ei}_1(-idx)}{4a^3} + \frac{3db\,\mathrm{e}^{-\frac{i(da-cb)}{b}} \mathrm{Ei}_1\left(-idx-ic-\frac{iad-icb}{b}\right)}{2a^4} + \frac{3ib^2 \mathrm{e}^{ic} \ldots}{\ldots}$ |

input
```
int(sin(d*x+c)/x^3/(b*x+a)^3,x,method=_RETURNVERBOSE)
```

output
```
d^2*(-3/d*b^3/a^4*(-sin(d*x+c)/(d*a-c*b+b*(d*x+c))/b+(Si(d*x+c+(a*d-b*c)/b
)*sin((a*d-b*c)/b)/b+Ci(d*x+c+(a*d-b*c)/b)*cos((a*d-b*c)/b)/b)/b)-6/d^2*b^
3/a^5*(Si(d*x+c+(a*d-b*c)/b)*cos((a*d-b*c)/b)/b-Ci(d*x+c+(a*d-b*c)/b)*sin(
(a*d-b*c)/b)/b)-b^3/a^3*(-1/2*sin(d*x+c)/(d*a-c*b+b*(d*x+c))^2/b+1/2*(-cos
(d*x+c)/(d*a-c*b+b*(d*x+c))/b-(Si(d*x+c+(a*d-b*c)/b)*cos((a*d-b*c)/b)/b-Ci
(d*x+c+(a*d-b*c)/b)*sin((a*d-b*c)/b)/b)/b)/b)+1/a^3*(-1/2*sin(d*x+c)/d^2/x
^2-1/2*cos(d*x+c)/d/x-1/2*Si(d*x)*cos(c)-1/2*Ci(d*x)*sin(c))-3/d/a^4*b*(-s
in(d*x+c)/d/x-Si(d*x)*sin(c)+Ci(d*x)*cos(c))+6/d^2/a^5*b^2*(Si(d*x)*cos(c)
+Ci(d*x)*sin(c)))
```

### 3.39.5 Fricas [A] (verification not implemented)

Time = 0.33 (sec) , antiderivative size = 585, normalized size of antiderivative = 1.55

$$\int \frac{\sin(c+dx)}{x^3(a+bx)^3}\,dx =$$
$$-\frac{(a^3bdx^2 + a^4dx)\cos(dx+c) + (6(ab^3dx^4 + 2a^2b^2dx^3 + a^3bdx^2)\operatorname{Ci}(dx) + ((a^2b^2d^2 - 12b^4)x^4 + 2(a^3b}{}$$

input
```
integrate(sin(d*x+c)/x^3/(b*x+a)^3,x, algorithm="fricas")
```

output
```
-1/2*((a^3*b*d*x^2 + a^4*d*x)*cos(d*x + c) + (6*(a*b^3*d*x^4 + 2*a^2*b^2*d
*x^3 + a^3*b*d*x^2)*cos_integral(d*x) + ((a^2*b^2*d^2 - 12*b^4)*x^4 + 2*(a
^3*b*d^2 - 12*a*b^3)*x^3 + (a^4*d^2 - 12*a^2*b^2)*x^2)*sin_integral(d*x))*
cos(c) + (6*(a*b^3*d*x^4 + 2*a^2*b^2*d*x^3 + a^3*b*d*x^2)*cos_integral((b*
d*x + a*d)/b) - ((a^2*b^2*d^2 - 12*b^4)*x^4 + 2*(a^3*b*d^2 - 12*a*b^3)*x^3
 + (a^4*d^2 - 12*a^2*b^2)*x^2)*sin_integral((b*d*x + a*d)/b))*cos(-(b*c -
a*d)/b) - (12*a*b^3*x^3 + 18*a^2*b^2*x^2 + 4*a^3*b*x - a^4)*sin(d*x + c) +
 (((a^2*b^2*d^2 - 12*b^4)*x^4 + 2*(a^3*b*d^2 - 12*a*b^3)*x^3 + (a^4*d^2 -
12*a^2*b^2)*x^2)*cos_integral(d*x) - 6*(a*b^3*d*x^4 + 2*a^2*b^2*d*x^3 + a^
3*b*d*x^2)*sin_integral(d*x))*sin(c) + (((a^2*b^2*d^2 - 12*b^4)*x^4 + 2*(a
^3*b*d^2 - 12*a*b^3)*x^3 + (a^4*d^2 - 12*a^2*b^2)*x^2)*cos_integral((b*d*x
 + a*d)/b) + 6*(a*b^3*d*x^4 + 2*a^2*b^2*d*x^3 + a^3*b*d*x^2)*sin_integral(
(b*d*x + a*d)/b))*sin(-(b*c - a*d)/b))/(a^5*b^2*x^4 + 2*a^6*b*x^3 + a^7*x^
2)
```

### 3.39.6 Sympy [F]

$$\int \frac{\sin(c+dx)}{x^3(a+bx)^3}\,dx = \int \frac{\sin(c+dx)}{x^3(a+bx)^3}\,dx$$

input
```
integrate(sin(d*x+c)/x**3/(b*x+a)**3,x)
```

output
```
Integral(sin(c + d*x)/(x**3*(a + b*x)**3), x)
```

### 3.39.7 Maxima [F]

$$\int \frac{\sin(c+dx)}{x^3(a+bx)^3}\,dx = \int \frac{\sin\left(dx+c\right)}{\left(bx+a\right)^3x^3}\,dx$$

input
```
integrate(sin(d*x+c)/x^3/(b*x+a)^3,x, algorithm="maxima")
```

output
```
integrate(sin(d*x + c)/((b*x + a)^3*x^3), x)
```

### 3.39.8 Giac [C] (verification not implemented)

Result contains higher order function than in optimal. Order 9 vs. order 4.

Time = 0.76 (sec) , antiderivative size = 24116, normalized size of antiderivative = 63.97

$$\int \frac{\sin(c+dx)}{x^3(a+bx)^3}\,dx = \text{Too large to display}$$

input
```
integrate(sin(d*x+c)/x^3/(b*x+a)^3,x, algorithm="giac")
```

output
```
1/4*(a^2*b^2*d^2*x^4*imag_part(cos_integral(d*x + a*d/b))*tan(1/2*d*x)^2*t
an(1/2*c)^2*tan(1/2*a*d/b)^2 + a^2*b^2*d^2*x^4*imag_part(cos_integral(d*x)
)*tan(1/2*d*x)^2*tan(1/2*c)^2*tan(1/2*a*d/b)^2 - a^2*b^2*d^2*x^4*imag_part
(cos_integral(-d*x - a*d/b))*tan(1/2*d*x)^2*tan(1/2*c)^2*tan(1/2*a*d/b)^2
- a^2*b^2*d^2*x^4*imag_part(cos_integral(-d*x))*tan(1/2*d*x)^2*tan(1/2*c)^
2*tan(1/2*a*d/b)^2 + 2*a^2*b^2*d^2*x^4*sin_integral(d*x)*tan(1/2*d*x)^2*ta
n(1/2*c)^2*tan(1/2*a*d/b)^2 + 2*a^2*b^2*d^2*x^4*sin_integral((b*d*x + a*d)
/b)*tan(1/2*d*x)^2*tan(1/2*c)^2*tan(1/2*a*d/b)^2 + 2*a^2*b^2*d^2*x^4*real_
part(cos_integral(d*x + a*d/b))*tan(1/2*d*x)^2*tan(1/2*c)^2*tan(1/2*a*d/b)
 + 2*a^2*b^2*d^2*x^4*real_part(cos_integral(-d*x - a*d/b))*tan(1/2*d*x)^2*
tan(1/2*c)^2*tan(1/2*a*d/b) - 2*a^2*b^2*d^2*x^4*real_part(cos_integral(d*x
 + a*d/b))*tan(1/2*d*x)^2*tan(1/2*c)*tan(1/2*a*d/b)^2 - 2*a^2*b^2*d^2*x^4*
real_part(cos_integral(d*x))*tan(1/2*d*x)^2*tan(1/2*c)*tan(1/2*a*d/b)^2 -
2*a^2*b^2*d^2*x^4*real_part(cos_integral(-d*x - a*d/b))*tan(1/2*d*x)^2*tan
(1/2*c)*tan(1/2*a*d/b)^2 - 2*a^2*b^2*d^2*x^4*real_part(cos_integral(-d*x))
*tan(1/2*d*x)^2*tan(1/2*c)*tan(1/2*a*d/b)^2 + 2*a^3*b*d^2*x^3*imag_part(co
s_integral(d*x + a*d/b))*tan(1/2*d*x)^2*tan(1/2*c)^2*tan(1/2*a*d/b)^2 + 2*
a^3*b*d^2*x^3*imag_part(cos_integral(d*x))*tan(1/2*d*x)^2*tan(1/2*c)^2*tan
(1/2*a*d/b)^2 - 2*a^3*b*d^2*x^3*imag_part(cos_integral(-d*x - a*d/b))*tan(
1/2*d*x)^2*tan(1/2*c)^2*tan(1/2*a*d/b)^2 - 2*a^3*b*d^2*x^3*imag_part(co...
```

### 3.39.9 Mupad [F(-1)]

Timed out.

$$\int \frac{\sin(c+dx)}{x^3(a+bx)^3}\,dx = \int \frac{\sin\left(c+d\,x\right)}{x^3\,{\left(a+b\,x\right)}^3}\,dx$$

input
```
int(sin(c + d*x)/(x^3*(a + b*x)^3),x)
```

output
```
int(sin(c + d*x)/(x^3*(a + b*x)^3), x)
```

# 3.40 $\int x^3(a+bx^2)\sin(c+dx)\,dx$



## 3.40.1 Optimal result

Integrand size = 17, antiderivative size = 141

$$\int x^3(a+bx^2)\sin(c+dx)\,dx = -\frac{120bx\cos(c+dx)}{d^5}+\frac{6ax\cos(c+dx)}{d^3}+\frac{20bx^3\cos(c+dx)}{d^3}-\frac{ax^3\cos(c+dx)}{d}-\frac{bx^5\cos(c+dx)}{d}+\frac{120b\sin(c+dx)}{d^6}-\frac{6a\sin(c+dx)}{d^4}-\frac{60bx^2\sin(c+dx)}{d^4}+\frac{3ax^2\sin(c+dx)}{d^2}+\frac{5bx^4\sin(c+dx)}{d^2}$$

output
```
-120*b*x*cos(d*x+c)/d^5+6*a*x*cos(d*x+c)/d^3+20*b*x^3*cos(d*x+c)/d^3-a*x^3
*cos(d*x+c)/d-b*x^5*cos(d*x+c)/d+120*b*sin(d*x+c)/d^6-6*a*sin(d*x+c)/d^4-6
0*b*x^2*sin(d*x+c)/d^4+3*a*x^2*sin(d*x+c)/d^2+5*b*x^4*sin(d*x+c)/d^2
```

## 3.40.2 Mathematica [A] (verified)

Time = 0.13 (sec) , antiderivative size = 92, normalized size of antiderivative = 0.65

$$\int x^3(a+bx^2)\sin(c+dx)\,dx = \frac{-dx(ad^2(-6+d^2x^2)+b(120-20d^2x^2+d^4x^4))\cos(c+dx)+(3ad^2(-2+d^2x^2)+5b(24-12d^2x^2+d^4x}{d^6}$$

input
```
Integrate[x^3*(a + b*x^2)*Sin[c + d*x],x]
```

output
```
(-(d*x*(a*d^2*(-6 + d^2*x^2) + b*(120 - 20*d^2*x^2 + d^4*x^4))*Cos[c + d*x
]) + (3*a*d^2*(-2 + d^2*x^2) + 5*b*(24 - 12*d^2*x^2 + d^4*x^4))*Sin[c + d*
x])/d^6
```

### 3.40.3 Rubi [A] (verified)

Time = 0.40 (sec) , antiderivative size = 141, normalized size of antiderivative = 1.00, number of steps used = 2, number of rules used = 2, $\frac{\text{number of rules}}{\text{integrand size}} = 0.118$, Rules used = {3820, 2009}

Below are the steps used by Rubi to obtain the solution. The rule number used for the transformation is given above next to the arrow. The rules definitions used are listed below.

$$\int x^3 (a + bx^2) \sin(c + dx) \, dx$$

$$\Big\downarrow \text{3820}$$

$$\int \left(ax^3 \sin(c + dx) + bx^5 \sin(c + dx)\right) dx$$

$$\Big\downarrow \text{2009}$$

$$-\frac{6a \sin(c + dx)}{d^4} + \frac{6ax \cos(c + dx)}{d^3} + \frac{3ax^2 \sin(c + dx)}{d^2} - \frac{ax^3 \cos(c + dx)}{d} + \frac{120b \sin(c + dx)}{d^6} - \frac{120bx \cos(c + dx)}{d^5} - \frac{60bx^2 \sin(c + dx)}{d^4} + \frac{20bx^3 \cos(c + dx)}{d^3} + \frac{5bx^4 \sin(c + dx)}{d^2} - \frac{bx^5 \cos(c + dx)}{d}$$

input
```
Int[x^3*(a + b*x^2)*Sin[c + d*x],x]
```

output
```
(-120*b*x*Cos[c + d*x])/d^5 + (6*a*x*Cos[c + d*x])/d^3 + (20*b*x^3*Cos[c +
 d*x])/d^3 - (a*x^3*Cos[c + d*x])/d - (b*x^5*Cos[c + d*x])/d + (120*b*Sin[
c + d*x])/d^6 - (6*a*Sin[c + d*x])/d^4 - (60*b*x^2*Sin[c + d*x])/d^4 + (3*
a*x^2*Sin[c + d*x])/d^2 + (5*b*x^4*Sin[c + d*x])/d^2
```

#### 3.40.3.1 Defintions of rubi rules used

rule 2009
```
Int[u_, x_Symbol] :> Simp[IntSum[u, x], x] /; SumQ[u]
```

rule 3820
```
Int[((e_.)*(x_))^(m_.)*((a_) + (b_.)*(x_)^(n_))^(p_.)*Sin[(c_.) + (d_.)*(x_
)], x_Symbol] :> Int[ExpandIntegrand[Sin[c + d*x], (e*x)^m*(a + b*x^n)^p, x
], x] /; FreeQ[{a, b, c, d, e, m, n}, x] && IGtQ[p, 0]
```

### 3.40.4 Maple [A] (verified)

Time = 0.17 (sec) , antiderivative size = 96, normalized size of antiderivative = 0.68

| method | result |
|---|---|
| risch | $-\frac{x\left(b\,x^{4}d^{4}+a\,d^{4}x^{2}-20d^{2}x^{2}b-6a\,d^{2}+120b\right)\cos\left(dx+c\right)}{d^{5}}+\frac{\left(5b\,x^{4}d^{4}+3a\,d^{4}x^{2}-60d^{2}x^{2}b-6a\,d^{2}+120b\right)\sin\left(dx+c\right)}{d^{6}}$ |
| parallelrisch | $\frac{\left(x^{2}\left(b\,x^{2}+a\right)d^{4}+\left(-20b\,x^{2}-6a\right)d^{2}+120b\right)xd\left(\tan^{2}\left(\frac{dx}{2}+\frac{c}{2}\right)\right)+\left(\left(10b\,x^{4}+6a\,x^{2}\right)d^{4}+\left(-120b\,x^{2}-12a\right)d^{2}+240b\right)\tan\left(\frac{dx}{2}+\right.}{d^{6}\left(1+\tan^{2}\left(\frac{dx}{2}+\frac{c}{2}\right)\right)}$ |
| norman | $\frac{\frac{b\,x^{5}\left(\tan^{2}\left(\frac{dx}{2}+\frac{c}{2}\right)\right)}{d}+\frac{\left(a\,d^{2}-20b\right)x^{3}\left(\tan^{2}\left(\frac{dx}{2}+\frac{c}{2}\right)\right)}{d^{3}}-\frac{b\,x^{5}}{d}+\frac{6\left(a\,d^{2}-20b\right)x}{d^{5}}-\frac{\left(a\,d^{2}-20b\right)x^{3}}{d^{3}}-\frac{12\left(a\,d^{2}-20b\right)\tan\left(\frac{dx}{2}+\frac{c}{2}\right)}{d^{6}}+\frac{10b\,x}{}}{1+\tan^{2}\left(\frac{dx}{2}+\frac{c}{2}\right)}$ |
| meijerg | $\frac{32b\sqrt{\pi}\,\sin\left(c\right)\left(-\frac{15}{4\sqrt{\pi}}+\frac{\left(\frac{15}{8}d^{4}x^{4}-\frac{45}{2}d^{2}x^{2}+45\right)\cos\left(dx\right)}{12\sqrt{\pi}}+\frac{xd\left(\frac{3}{8}d^{4}x^{4}-\frac{15}{2}d^{2}x^{2}+45\right)\sin\left(dx\right)}{12\sqrt{\pi}}\right)}{d^{6}}+\frac{32b\sqrt{\pi}\,\cos\left(c\right)\left(-\frac{xd\left(\frac{7}{8}d^{4}x^{4}\right.}{}\right.}{}$ |
| parts | $-\frac{b\,x^{5}\cos\left(dx+c\right)}{d}-\frac{a\,x^{3}\cos\left(dx+c\right)}{d}+\frac{\frac{3a\,c^{2}\sin\left(dx+c\right)}{d^{2}}-\frac{6ac\left(\cos\left(dx+c\right)+\left(dx+c\right)\sin\left(dx+c\right)\right)}{d^{2}}+\frac{3a\left(\left(dx+c\right)^{2}\sin\left(dx+c\right)-2\sin\left(d\right.\right.}{d^{2}}}{}$ |
| derivativedivides | $\frac{a\,c^{3}\cos\left(dx+c\right)+3a\,c^{2}\left(\sin\left(dx+c\right)-\cos\left(dx+c\right)\left(dx+c\right)\right)-3ac\left(-\left(dx+c\right)^{2}\cos\left(dx+c\right)+2\cos\left(dx+c\right)+2\left(dx+c\right)\sin\left(dx+c\right)\right)+c}{}$ |
| default | $\frac{a\,c^{3}\cos\left(dx+c\right)+3a\,c^{2}\left(\sin\left(dx+c\right)-\cos\left(dx+c\right)\left(dx+c\right)\right)-3ac\left(-\left(dx+c\right)^{2}\cos\left(dx+c\right)+2\cos\left(dx+c\right)+2\left(dx+c\right)\sin\left(dx+c\right)\right)+c}{}$ |

input
```
int(x^3*(b*x^2+a)*sin(d*x+c),x,method=_RETURNVERBOSE)
```

output
```
-1/d^5*x*(b*d^4*x^4+a*d^4*x^2-20*b*d^2*x^2-6*a*d^2+120*b)*cos(d*x+c)+(5*b*
d^4*x^4+3*a*d^4*x^2-60*b*d^2*x^2-6*a*d^2+120*b)/d^6*sin(d*x+c)
```

### 3.40.5 Fricas [A] (verification not implemented)

Time = 0.30 (sec) , antiderivative size = 95, normalized size of antiderivative = 0.67

$$\int x^3(a+bx^2)\sin(c+dx)\,dx =$$
$$-\frac{(bd^5x^5+(ad^5-20\,bd^3)x^3-6\,(ad^3-20\,bd)x)\cos{(dx+c)}-(5\,bd^4x^4-6\,ad^2+3\,(ad^4-20\,bd^2)x^2+12}{d^6}$$

input
```
integrate(x^3*(b*x^2+a)*sin(d*x+c),x, algorithm="fricas")
```

output
```
-((b*d^5*x^5 + (a*d^5 - 20*b*d^3)*x^3 - 6*(a*d^3 - 20*b*d)*x)*cos(d*x + c)
 - (5*b*d^4*x^4 - 6*a*d^2 + 3*(a*d^4 - 20*b*d^2)*x^2 + 120*b)*sin(d*x + c)
)/d^6
```

### 3.40.6 Sympy [A] (verification not implemented)

Time = 0.42 (sec) , antiderivative size = 168, normalized size of antiderivative = 1.19

$$\int x^3(a+bx^2)\sin(c+dx)\,dx$$
$$=\begin{cases} -\frac{ax^3\cos{(c+dx)}}{d}+\frac{3ax^2\sin{(c+dx)}}{d^2}+\frac{6ax\cos{(c+dx)}}{d^3}-\frac{6a\sin{(c+dx)}}{d^4}-\frac{bx^5\cos{(c+dx)}}{d}+\frac{5bx^4\sin{(c+dx)}}{d^2}+\frac{20bx^3\cos{(c+dx)}}{d^3}- \\ \left(\frac{ax^4}{4}+\frac{bx^6}{6}\right)\sin{(c)} \end{cases}$$

input
```
integrate(x**3*(b*x**2+a)*sin(d*x+c),x)
```

output
```
Piecewise((-a*x**3*cos(c + d*x)/d + 3*a*x**2*sin(c + d*x)/d**2 + 6*a*x*cos
(c + d*x)/d**3 - 6*a*sin(c + d*x)/d**4 - b*x**5*cos(c + d*x)/d + 5*b*x**4*
sin(c + d*x)/d**2 + 20*b*x**3*cos(c + d*x)/d**3 - 60*b*x**2*sin(c + d*x)/d
**4 - 120*b*x*cos(c + d*x)/d**5 + 120*b*sin(c + d*x)/d**6, Ne(d, 0)), ((a*
x**4/4 + b*x**6/6)*sin(c), True))
```

### 3.40.7 Maxima [B] (verification not implemented)

Leaf count of result is larger than twice the leaf count of optimal. 372 vs. $2(141) = 282$.

Time = 0.20 (sec) , antiderivative size = 372, normalized size of antiderivative = 2.64

$$\int x^3(a+bx^2)\sin(c+dx)\,dx$$

$$= \frac{ac^3\cos(dx+c) + \frac{bc^5\cos(dx+c)}{d^2} - 3\left((dx+c)\cos(dx+c) - \sin(dx+c)\right)ac^2 - \frac{5\left((dx+c)\cos(dx+c)-\sin(dx+c)\right)bc^4}{d^2} -}{}$$

input
```
integrate(x^3*(b*x^2+a)*sin(d*x+c),x, algorithm="maxima")
```

output
```
(a*c^3*cos(d*x + c) + b*c^5*cos(d*x + c)/d^2 - 3*((d*x + c)*cos(d*x + c) -
 sin(d*x + c))*a*c^2 - 5*((d*x + c)*cos(d*x + c) - sin(d*x + c))*b*c^4/d^2
 + 3*(((d*x + c)^2 - 2)*cos(d*x + c) - 2*(d*x + c)*sin(d*x + c))*a*c + 10*
(((d*x + c)^2 - 2)*cos(d*x + c) - 2*(d*x + c)*sin(d*x + c))*b*c^3/d^2 - ((
(d*x + c)^3 - 6*d*x - 6*c)*cos(d*x + c) - 3*((d*x + c)^2 - 2)*sin(d*x + c)
)*a - 10*(((d*x + c)^3 - 6*d*x - 6*c)*cos(d*x + c) - 3*((d*x + c)^2 - 2)*s
in(d*x + c))*b*c^2/d^2 + 5*(((d*x + c)^4 - 12*(d*x + c)^2 + 24)*cos(d*x +
c) - 4*((d*x + c)^3 - 6*d*x - 6*c)*sin(d*x + c))*b*c/d^2 - (((d*x + c)^5 -
 20*(d*x + c)^3 + 120*d*x + 120*c)*cos(d*x + c) - 5*((d*x + c)^4 - 12*(d*x
 + c)^2 + 24)*sin(d*x + c))*b/d^2)/d^4
```

### 3.40.8 Giac [A] (verification not implemented)

Time = 0.30 (sec) , antiderivative size = 97, normalized size of antiderivative = 0.69

$$\int x^3(a+bx^2)\sin(c+dx)\,dx = -\frac{(bd^5x^5 + ad^5x^3 - 20\,bd^3x^3 - 6\,ad^3x + 120\,bdx)\cos(dx+c)}{d^6} + \frac{(5\,bd^4x^4 + 3\,ad^4x^2 - 60\,bd^2x^2 - 6\,ad^2 + 120\,b)\sin(dx+c)}{d^6}$$

input
```
integrate(x^3*(b*x^2+a)*sin(d*x+c),x, algorithm="giac")
```

output
```
-(b*d^5*x^5 + a*d^5*x^3 - 20*b*d^3*x^3 - 6*a*d^3*x + 120*b*d*x)*cos(d*x +
c)/d^6 + (5*b*d^4*x^4 + 3*a*d^4*x^2 - 60*b*d^2*x^2 - 6*a*d^2 + 120*b)*sin(
d*x + c)/d^6
```

### 3.40.9 Mupad [B] (verification not implemented)

Time = 0.44 (sec) , antiderivative size = 121, normalized size of antiderivative = 0.86

$$\int x^3(a+bx^2)\sin(c+dx)\,dx = \frac{6\,\sin\left(c+d\,x\right)\,\left(20\,b-a\,d^2\right)}{d^6}+\frac{x^3\,\cos\left(c+d\,x\right)\,\left(20\,b-a\,d^2\right)}{d^3} - \frac{3\,x^2\,\sin\left(c+d\,x\right)\,\left(20\,b-a\,d^2\right)}{d^4} - \frac{6\,x\,\cos\left(c+d\,x\right)\,\left(20\,b-a\,d^2\right)}{d^5} - \frac{b\,x^5\,\cos\left(c+d\,x\right)}{d}+\frac{5\,b\,x^4\,\sin\left(c+d\,x\right)}{d^2}$$

input
```
int(x^3*sin(c + d*x)*(a + b*x^2),x)
```

output
```
(6*sin(c + d*x)*(20*b - a*d^2))/d^6 + (x^3*cos(c + d*x)*(20*b - a*d^2))/d^
3 - (3*x^2*sin(c + d*x)*(20*b - a*d^2))/d^4 - (6*x*cos(c + d*x)*(20*b - a*
d^2))/d^5 - (b*x^5*cos(c + d*x))/d + (5*b*x^4*sin(c + d*x))/d^2
```

# 3.41 $\int x^2(a+bx^2)\sin(c+dx)\,dx$



## 3.41.1 Optimal result

Integrand size = 17, antiderivative size = 111

$$\int x^2(a+bx^2)\sin(c+dx)\,dx = -\frac{24b\cos(c+dx)}{d^5}+\frac{2a\cos(c+dx)}{d^3}+\frac{12bx^2\cos(c+dx)}{d^3}-\frac{ax^2\cos(c+dx)}{d}-\frac{bx^4\cos(c+dx)}{d}-\frac{24bx\sin(c+dx)}{d^4}+\frac{2ax\sin(c+dx)}{d^2}+\frac{4bx^3\sin(c+dx)}{d^2}$$

output
```
-24*b*cos(d*x+c)/d^5+2*a*cos(d*x+c)/d^3+12*b*x^2*cos(d*x+c)/d^3-a*x^2*cos(
d*x+c)/d-b*x^4*cos(d*x+c)/d-24*b*x*sin(d*x+c)/d^4+2*a*x*sin(d*x+c)/d^2+4*b
*x^3*sin(d*x+c)/d^2
```

## 3.41.2 Mathematica [A] (verified)

Time = 0.08 (sec) , antiderivative size = 75, normalized size of antiderivative = 0.68

$$\int x^2(a+bx^2)\sin(c+dx)\,dx = \frac{-((ad^2(-2+d^2x^2)+b(24-12d^2x^2+d^4x^4))\cos(c+dx))+2dx(ad^2+2b(-6+d^2x^2))\sin(c+dx)}{d^5}$$

input
```
Integrate[x^2*(a + b*x^2)*Sin[c + d*x],x]
```

output
```
(-((a*d^2*(-2 + d^2*x^2) + b*(24 - 12*d^2*x^2 + d^4*x^4))*Cos[c + d*x]) +
2*d*x*(a*d^2 + 2*b*(-6 + d^2*x^2))*Sin[c + d*x])/d^5
```

### 3.41.3 Rubi [A] (verified)

Time = 0.33 (sec) , antiderivative size = 111, normalized size of antiderivative = 1.00, number of steps used = 2, number of rules used = 2, $\frac{\text{number of rules}}{\text{integrand size}} = 0.118$, Rules used = {3820, 2009}

Below are the steps used by Rubi to obtain the solution. The rule number used for the transformation is given above next to the arrow. The rules definitions used are listed below.

$$\int x^2 (a+bx^2) \sin(c+dx) \, dx$$

$$\Big\downarrow \text{3820}$$

$$\int \left(ax^2 \sin(c+dx)+bx^4 \sin(c+dx)\right) dx$$

$$\Big\downarrow \text{2009}$$

$$\frac{2a\cos(c+dx)}{d^3}+\frac{2ax\sin(c+dx)}{d^2}-\frac{ax^2\cos(c+dx)}{d}-\frac{24b\cos(c+dx)}{d^5}-\frac{24bx\sin(c+dx)}{d^4}+\frac{12bx^2\cos(c+dx)}{d^3}+\frac{4bx^3\sin(c+dx)}{d^2}-\frac{bx^4\cos(c+dx)}{d}$$

input
```
Int[x^2*(a + b*x^2)*Sin[c + d*x],x]
```

output
```
(-24*b*Cos[c + d*x])/d^5 + (2*a*Cos[c + d*x])/d^3 + (12*b*x^2*Cos[c + d*x]
)/d^3 - (a*x^2*Cos[c + d*x])/d - (b*x^4*Cos[c + d*x])/d - (24*b*x*Sin[c +
d*x])/d^4 + (2*a*x*Sin[c + d*x])/d^2 + (4*b*x^3*Sin[c + d*x])/d^2
```

#### 3.41.3.1 Defintions of rubi rules used

rule 2009
```
Int[u_, x_Symbol] :> Simp[IntSum[u, x], x] /; SumQ[u]
```

rule 3820
```
Int[((e_.)*(x_))^(m_.)*((a_) + (b_.)*(x_)^(n_))^(p_.)*Sin[(c_.) + (d_.)*(x_
)], x_Symbol] :> Int[ExpandIntegrand[Sin[c + d*x], (e*x)^m*(a + b*x^n)^p, x
], x] /; FreeQ[{a, b, c, d, e, m, n}, x] && IGtQ[p, 0]
```

### 3.41.4 Maple [A] (verified)

Time = 0.15 (sec) , antiderivative size = 78, normalized size of antiderivative = 0.70

| method | result |
|---|---|
| risch | $-\frac{\left(b\,x^{4} d^{4}+a\,d^{4} x^{2}-12 d^{2} x^{2} b-2 a\,d^{2}+24 b\right) \cos \left(d x+c\right)}{d^{5}}+\frac{2 x \left(2 d^{2} x^{2} b+a\,d^{2}-12 b\right) \sin \left(d x+c\right)}{d^{4}}$ |
| parallelrisch | $\frac{\left(\left(b\,x^{2}+a\right) d^{2}-12 b\right) x^{2} d^{2} \left(\tan^{2}\left(\frac{d x}{2}+\frac{c}{2}\right)\right)+4 \left(\left(2 b\,x^{2}+a\right) d^{2}-12 b\right) x d \tan \left(\frac{d x}{2}+\frac{c}{2}\right)+\left(-b\,x^{4}-a\,x^{2}\right) d^{4}+4 \left(3 b\,x^{2}+a\right) d^{2}-48 b}{d^{5} \left(1+\tan^{2}\left(\frac{d x}{2}+\frac{c}{2}\right)\right)}$ |
| norman | $\frac{\frac{4 a\,d^{2}-48 b}{d^{5}}+\frac{b\,x^{4} \left(\tan^{2}\left(\frac{d x}{2}+\frac{c}{2}\right)\right)}{d}+\frac{\left(a\,d^{2}-12 b\right) x^{2} \left(\tan^{2}\left(\frac{d x}{2}+\frac{c}{2}\right)\right)}{d^{3}}-\frac{b\,x^{4}}{d}-\frac{\left(a\,d^{2}-12 b\right) x^{2}}{d^{3}}+\frac{8 b\,x^{3} \tan \left(\frac{d x}{2}+\frac{c}{2}\right)}{d^{2}}+\frac{4 \left(a\,d^{2}-12 b\right) x \tan}{d^{4}}}{1+\tan^{2}\left(\frac{d x}{2}+\frac{c}{2}\right)}$ |
| parts | $-\frac{b\,x^{4} \cos \left(d x+c\right)}{d}-\frac{a\,x^{2} \cos \left(d x+c\right)}{d}+\frac{-\frac{2 a c \sin \left(d x+c\right)}{d}+\frac{2 a \left(\cos \left(d x+c\right)+\left(d x+c\right) \sin \left(d x+c\right)\right)}{d}-\frac{4 b\,c^{3} \sin \left(d x+c\right)}{d^{3}}+\frac{12 b\,c^{2} (\cos (dx}{}$ |
| meijerg | $\frac{16 b \sqrt{\pi}\, \sin \left(c \right) \left(-\frac{x \left(d^{2}\right)^{\frac{5}{2}} \left(-\frac{5 d^{2} x^{2}}{2}+15\right) \cos \left(d x \right)}{10 \sqrt{\pi}\, d^{4}}+\frac{\left(d^{2}\right)^{\frac{5}{2}} \left(\frac{5}{8} d^{4} x^{4}-\frac{15}{2} d^{2} x^{2}+15\right) \sin \left(d x \right)}{10 \sqrt{\pi}\, d^{5}}\right)}{d^{4} \sqrt{d^{2}}}+\frac{16 b \sqrt{\pi}\, \cos \left(c \right) \left(\frac{3}{2 \sqrt{\pi}}-\frac{\left(\frac{3}{8} d^{4} x^{4}}{}\right.}{}$ |
| derivativedivides | $\frac{-a\,c^{2} \cos \left(d x+c\right)-2 a c \left(\sin \left(d x+c\right)-\cos \left(d x+c\right) \left(d x+c\right)\right)+a \left(-\left(d x+c\right)^{2} \cos \left(d x+c\right)+2 \cos \left(d x+c\right)+2 \left(d x+c\right) \sin \left(d x+c\right)\right)-\frac{b\,c}{}}{}$ |
| default | $\frac{-a\,c^{2} \cos \left(d x+c\right)-2 a c \left(\sin \left(d x+c\right)-\cos \left(d x+c\right) \left(d x+c\right)\right)+a \left(-\left(d x+c\right)^{2} \cos \left(d x+c\right)+2 \cos \left(d x+c\right)+2 \left(d x+c\right) \sin \left(d x+c\right)\right)-\frac{b\,c}{}}{}$ |

input
```
int(x^2*(b*x^2+a)*sin(d*x+c),x,method=_RETURNVERBOSE)
```

output
```
-(b*d^4*x^4+a*d^4*x^2-12*b*d^2*x^2-2*a*d^2+24*b)/d^5*cos(d*x+c)+2/d^4*x*(2
*b*d^2*x^2+a*d^2-12*b)*sin(d*x+c)
```

### 3.41.5 Fricas [A] (verification not implemented)

Time = 0.27 (sec) , antiderivative size = 77, normalized size of antiderivative = 0.69

$$\int x^2 (a + bx^2) \sin(c + dx) \, dx = -\frac{(bd^4x^4 - 2\,ad^2 + (ad^4 - 12\,bd^2)x^2 + 24\,b) \cos{(dx + c)} - 2\,(2\,bd^3x^3 + (ad^3 - 12\,bd)x) \sin{(dx + c)}}{d^5}$$

input
```
integrate(x^2*(b*x^2+a)*sin(d*x+c),x, algorithm="fricas")
```

output
```
-((b*d^4*x^4 - 2*a*d^2 + (a*d^4 - 12*b*d^2)*x^2 + 24*b)*cos(d*x + c) - 2*(
2*b*d^3*x^3 + (a*d^3 - 12*b*d)*x)*sin(d*x + c))/d^5
```

### 3.41.6 Sympy [A] (verification not implemented)

Time = 0.32 (sec) , antiderivative size = 134, normalized size of antiderivative = 1.21

$$\int x^2(a+bx^2)\sin(c+dx)\,dx$$
$$=\begin{cases} -\frac{ax^2\cos(c+dx)}{d}+\frac{2ax\sin(c+dx)}{d^2}+\frac{2a\cos(c+dx)}{d^3}-\frac{bx^4\cos(c+dx)}{d}+\frac{4bx^3\sin(c+dx)}{d^2}+\frac{12bx^2\cos(c+dx)}{d^3}-\frac{24bx\sin(c+dx)}{d^4}- \\ \left(\frac{ax^3}{3}+\frac{bx^5}{5}\right)\sin(c) \end{cases}$$

input
```
integrate(x**2*(b*x**2+a)*sin(d*x+c),x)
```

output
```
Piecewise((-a*x**2*cos(c + d*x)/d + 2*a*x*sin(c + d*x)/d**2 + 2*a*cos(c +
d*x)/d**3 - b*x**4*cos(c + d*x)/d + 4*b*x**3*sin(c + d*x)/d**2 + 12*b*x**2
*cos(c + d*x)/d**3 - 24*b*x*sin(c + d*x)/d**4 - 24*b*cos(c + d*x)/d**5, Ne
(d, 0)), ((a*x**3/3 + b*x**5/5)*sin(c), True))
```

### 3.41.7 Maxima [B] (verification not implemented)

Leaf count of result is larger than twice the leaf count of optimal. 258 vs. 2(111) = 222.

Time = 0.19 (sec) , antiderivative size = 258, normalized size of antiderivative = 2.32

$$\int x^2(a+bx^2)\sin(c+dx)\,dx =$$

$$-\frac{ac^2\cos(dx+c)+\frac{bc^4\cos(dx+c)}{d^2}-2\left((dx+c)\cos(dx+c)-\sin(dx+c)\right)ac-\frac{4((dx+c)\cos(dx+c)-\sin(dx+c))bc^3}{d^2}}{}$$

input
```
integrate(x^2*(b*x^2+a)*sin(d*x+c),x, algorithm="maxima")
```

output
```
-(a*c^2*cos(d*x + c) + b*c^4*cos(d*x + c)/d^2 - 2*((d*x + c)*cos(d*x + c)
- sin(d*x + c))*a*c - 4*((d*x + c)*cos(d*x + c) - sin(d*x + c))*b*c^3/d^2
+ (((d*x + c)^2 - 2)*cos(d*x + c) - 2*(d*x + c)*sin(d*x + c))*a + 6*(((d*x
 + c)^2 - 2)*cos(d*x + c) - 2*(d*x + c)*sin(d*x + c))*b*c^2/d^2 - 4*(((d*x
 + c)^3 - 6*d*x - 6*c)*cos(d*x + c) - 3*((d*x + c)^2 - 2)*sin(d*x + c))*b*
c/d^2 + (((d*x + c)^4 - 12*(d*x + c)^2 + 24)*cos(d*x + c) - 4*((d*x + c)^3
 - 6*d*x - 6*c)*sin(d*x + c))*b/d^2)/d^3
```

### 3.41.8 Giac [A] (verification not implemented)

Time = 0.28 (sec) , antiderivative size = 79, normalized size of antiderivative = 0.71

$$\int x^2(a+bx^2)\sin(c+dx)\,dx = -\frac{(bd^4x^4+ad^4x^2-12\,bd^2x^2-2\,ad^2+24\,b)\cos(dx+c)}{d^5} + \frac{2\,(2\,bd^3x^3+ad^3x-12\,bdx)\sin(dx+c)}{d^5}$$

input
```
integrate(x^2*(b*x^2+a)*sin(d*x+c),x, algorithm="giac")
```

output
```
-(b*d^4*x^4 + a*d^4*x^2 - 12*b*d^2*x^2 - 2*a*d^2 + 24*b)*cos(d*x + c)/d^5
+ 2*(2*b*d^3*x^3 + a*d^3*x - 12*b*d*x)*sin(d*x + c)/d^5
```

### 3.41.9 Mupad [B] (verification not implemented)

Time = 6.07 (sec) , antiderivative size = 97, normalized size of antiderivative = 0.87

$$\int x^2(a+bx^2)\sin(c+dx)\,dx = \frac{x^2\cos(c+d\,x)\,(12\,b-a\,d^2)}{d^3} - \frac{2\cos(c+d\,x)\,(12\,b-a\,d^2)}{d^5} - \frac{2\,x\sin(c+d\,x)\,(12\,b-a\,d^2)}{d^4} - \frac{b\,x^4\cos(c+d\,x)}{d} + \frac{4\,b\,x^3\sin(c+d\,x)}{d^2}$$

input
```
int(x^2*sin(c + d*x)*(a + b*x^2),x)
```

output
```
(x^2*cos(c + d*x)*(12*b - a*d^2))/d^3 - (2*cos(c + d*x)*(12*b - a*d^2))/d^
5 - (2*x*sin(c + d*x)*(12*b - a*d^2))/d^4 - (b*x^4*cos(c + d*x))/d + (4*b*
x^3*sin(c + d*x))/d^2
```

# 3.42 $\int x(a+bx^2)\sin(c+dx)\,dx$



## 3.42.1 Optimal result

Integrand size = 15, antiderivative size = 80

$$\int x(a+bx^2)\sin(c+dx)\,dx = \frac{6bx\cos(c+dx)}{d^3} - \frac{ax\cos(c+dx)}{d} - \frac{bx^3\cos(c+dx)}{d} - \frac{6b\sin(c+dx)}{d^4} + \frac{a\sin(c+dx)}{d^2} + \frac{3bx^2\sin(c+dx)}{d^2}$$

output
```
6*b*x*cos(d*x+c)/d^3-a*x*cos(d*x+c)/d-b*x^3*cos(d*x+c)/d-6*b*sin(d*x+c)/d^
4+a*sin(d*x+c)/d^2+3*b*x^2*sin(d*x+c)/d^2
```

## 3.42.2 Mathematica [A] (verified)

Time = 0.06 (sec) , antiderivative size = 57, normalized size of antiderivative = 0.71

$$\int x(a+bx^2)\sin(c+dx)\,dx = \frac{-dx(ad^2+b(-6+d^2x^2))\cos(c+dx)+(ad^2+3b(-2+d^2x^2))\sin(c+dx)}{d^4}$$

input
```
Integrate[x*(a + b*x^2)*Sin[c + d*x],x]
```

output
```
(-(d*x*(a*d^2 + b*(-6 + d^2*x^2))*Cos[c + d*x]) + (a*d^2 + 3*b*(-2 + d^2*x
^2))*Sin[c + d*x])/d^4
```

### 3.42.3 Rubi [A] (verified)

Time = 0.27 (sec) , antiderivative size = 80, normalized size of antiderivative = 1.00, number of steps used = 2, number of rules used = 2, $\frac{\text{number of rules}}{\text{integrand size}} = 0.133$, Rules used = {3820, 2009}

Below are the steps used by Rubi to obtain the solution. The rule number used for the transformation is given above next to the arrow. The rules definitions used are listed below.

$$\int x\left(a+bx^2\right)\sin(c+dx)\,dx$$

$$\Big\downarrow \text{3820}$$

$$\int \left(ax\sin(c+dx)+bx^3\sin(c+dx)\right)dx$$

$$\Big\downarrow \text{2009}$$

$$\frac{a\sin(c+dx)}{d^2}-\frac{ax\cos(c+dx)}{d}-\frac{6b\sin(c+dx)}{d^4}+\frac{6bx\cos(c+dx)}{d^3}+\frac{3bx^2\sin(c+dx)}{d^2}-\frac{bx^3\cos(c+dx)}{d}$$

input
```
Int[x*(a + b*x^2)*Sin[c + d*x],x]
```

output
```
(6*b*x*Cos[c + d*x])/d^3 - (a*x*Cos[c + d*x])/d - (b*x^3*Cos[c + d*x])/d -
 (6*b*Sin[c + d*x])/d^4 + (a*Sin[c + d*x])/d^2 + (3*b*x^2*Sin[c + d*x])/d^
2
```

#### 3.42.3.1 Defintions of rubi rules used

rule 2009
```
Int[u_, x_Symbol] :> Simp[IntSum[u, x], x] /; SumQ[u]
```

rule 3820
```
Int[((e_.)*(x_))^(m_.)*((a_) + (b_.)*(x_)^(n_))^(p_.)*Sin[(c_.) + (d_.)*(x_
)], x_Symbol] :> Int[ExpandIntegrand[Sin[c + d*x], (e*x)^m*(a + b*x^n)^p, x
], x] /; FreeQ[{a, b, c, d, e, m, n}, x] && IGtQ[p, 0]
```

### 3.42.4 Maple [A] (verified)

Time = 0.16 (sec) , antiderivative size = 59, normalized size of antiderivative = 0.74

| method | result |
|---|---|
| risch | $-\frac{x(d^2x^2b+a\,d^2-6b)\cos(dx+c)}{d^3}+\frac{(3d^2x^2b+a\,d^2-6b)\sin(dx+c)}{d^4}$ |
| parallelrisch | $\frac{((b\,x^2+a)d^2-6b)xd\left(\tan^2\left(\frac{dx}{2}+\frac{c}{2}\right)\right)+2((3b\,x^2+a)d^2-6b)\tan\left(\frac{dx}{2}+\frac{c}{2}\right)-((b\,x^2+a)d^2-6b)xd}{d^4\left(1+\tan^2\left(\frac{dx}{2}+\frac{c}{2}\right)\right)}$ |
| parts | $-\frac{b\,x^3\cos(dx+c)}{d}-\frac{ax\cos(dx+c)}{d}+\frac{a\sin(dx+c)+\frac{3b\,c^2\sin(dx+c)}{d^2}-\frac{6bc(\cos(dx+c)+(dx+c)\sin(dx+c))}{d^2}+\frac{3b\left((dx+c)^2\sin(dx\right.}{}}{d^2}$ |
| norman | $\frac{\frac{b\,x^3\left(\tan^2\left(\frac{dx}{2}+\frac{c}{2}\right)\right)}{d}+\frac{(a\,d^2-6b)x\left(\tan^2\left(\frac{dx}{2}+\frac{c}{2}\right)\right)}{d^3}-\frac{b\,x^3}{d}-\frac{(a\,d^2-6b)x}{d^3}+\frac{2(a\,d^2-6b)\tan\left(\frac{dx}{2}+\frac{c}{2}\right)}{d^4}+\frac{6b\,x^2\tan\left(\frac{dx}{2}+\frac{c}{2}\right)}{d^2}}{1+\tan^2\left(\frac{dx}{2}+\frac{c}{2}\right)}$ |
| meijerg | $\frac{8b\sqrt{\pi}\,\sin(c)\left(\frac{3}{4\sqrt{\pi}}-\frac{\left(-\frac{3d^2x^2}{2}+3\right)\cos(dx)}{4\sqrt{\pi}}-\frac{dx\left(-\frac{d^2x^2}{2}+3\right)\sin(dx)}{4\sqrt{\pi}}\right)}{d^4}+\frac{8b\sqrt{\pi}\,\cos(c)\left(\frac{xd\left(-\frac{5d^2x^2}{2}+15\right)\cos(dx)}{20\sqrt{\pi}}-\frac{\left(-\frac{15d\right.}{}}{}\right.}{d^4}$ |
| derivativedivides | $\frac{ac\cos(dx+c)+a(\sin(dx+c)-\cos(dx+c)(dx+c))+\frac{b\,c^3\cos(dx+c)}{d^2}+\frac{3b\,c^2(\sin(dx+c)-\cos(dx+c)(dx+c))}{d^2}-\frac{3bc\left(-(dx+c)^2\cos(dx\right.}{}}{d^2}$ |
| default | $\frac{ac\cos(dx+c)+a(\sin(dx+c)-\cos(dx+c)(dx+c))+\frac{b\,c^3\cos(dx+c)}{d^2}+\frac{3b\,c^2(\sin(dx+c)-\cos(dx+c)(dx+c))}{d^2}-\frac{3bc\left(-(dx+c)^2\cos(dx\right.}{}}{d^2}$ |

input
```
int(x*(b*x^2+a)*sin(d*x+c),x,method=_RETURNVERBOSE)
```

output
```
-1/d^3*x*(b*d^2*x^2+a*d^2-6*b)*cos(d*x+c)+(3*b*d^2*x^2+a*d^2-6*b)/d^4*sin(
d*x+c)
```

### 3.42.5 Fricas [A] (verification not implemented)

Time = 0.28 (sec) , antiderivative size = 60, normalized size of antiderivative = 0.75

$$\int x(a+bx^2)\sin(c+dx)\,dx$$
$$=-\frac{(bd^3x^3+(ad^3-6\,bd)x)\cos(dx+c)-(3\,bd^2x^2+ad^2-6\,b)\sin(dx+c)}{d^4}$$

input
```
integrate(x*(b*x^2+a)*sin(d*x+c),x, algorithm="fricas")
```

output
```
-((b*d^3*x^3 + (a*d^3 - 6*b*d)*x)*cos(d*x + c) - (3*b*d^2*x^2 + a*d^2 - 6*
b)*sin(d*x + c))/d^4
```

### 3.42.6 Sympy [A] (verification not implemented)

Time = 0.26 (sec) , antiderivative size = 99, normalized size of antiderivative = 1.24

$$\int x(a+bx^2)\sin(c+dx)\,dx$$
$$=\begin{cases} -\frac{ax\cos(c+dx)}{d}+\frac{a\sin(c+dx)}{d^2}-\frac{bx^3\cos(c+dx)}{d}+\frac{3bx^2\sin(c+dx)}{d^2}+\frac{6bx\cos(c+dx)}{d^3}-\frac{6b\sin(c+dx)}{d^4} & \text{for } d\neq 0 \\ \left(\frac{ax^2}{2}+\frac{bx^4}{4}\right)\sin(c) & \text{otherwise} \end{cases}$$

input
```
integrate(x*(b*x**2+a)*sin(d*x+c),x)
```

output
```
Piecewise((-a*x*cos(c + d*x)/d + a*sin(c + d*x)/d**2 - b*x**3*cos(c + d*x)
/d + 3*b*x**2*sin(c + d*x)/d**2 + 6*b*x*cos(c + d*x)/d**3 - 6*b*sin(c + d*
x)/d**4, Ne(d, 0)), ((a*x**2/2 + b*x**4/4)*sin(c), True))
```

### 3.42.7 Maxima [B] (verification not implemented)

Leaf count of result is larger than twice the leaf count of optimal. 165 vs. 2(80) = 160.

Time = 0.19 (sec) , antiderivative size = 165, normalized size of antiderivative = 2.06

$$\int x(a+bx^2)\sin(c+dx)\,dx$$
$$=\frac{ac\cos(dx+c)+\frac{bc^3\cos(dx+c)}{d^2}-((dx+c)\cos(dx+c)-\sin(dx+c))a-\frac{3((dx+c)\cos(dx+c)-\sin(dx+c))bc^2}{d^2}+\frac{3((\cdots}{\cdots}}{d^2}$$

input
```
integrate(x*(b*x^2+a)*sin(d*x+c),x, algorithm="maxima")
```

output
```
(a*c*cos(d*x + c) + b*c^3*cos(d*x + c)/d^2 - ((d*x + c)*cos(d*x + c) - sin
(d*x + c))*a - 3*((d*x + c)*cos(d*x + c) - sin(d*x + c))*b*c^2/d^2 + 3*(((
d*x + c)^2 - 2)*cos(d*x + c) - 2*(d*x + c)*sin(d*x + c))*b*c/d^2 - (((d*x
+ c)^3 - 6*d*x - 6*c)*cos(d*x + c) - 3*((d*x + c)^2 - 2)*sin(d*x + c))*b/d
^2)/d^2
```

### 3.42.8 Giac [A] (verification not implemented)

Time = 0.30 (sec) , antiderivative size = 60, normalized size of antiderivative = 0.75

$$\int x(a+bx^2)\sin(c+dx)\,dx = -\frac{(bd^3x^3 + ad^3x - 6\,bdx)\cos{(dx+c)}}{d^4} + \frac{(3\,bd^2x^2 + ad^2 - 6\,b)\sin{(dx+c)}}{d^4}$$

input
```
integrate(x*(b*x^2+a)*sin(d*x+c),x, algorithm="giac")
```

output
```
-(b*d^3*x^3 + a*d^3*x - 6*b*d*x)*cos(d*x + c)/d^4 + (3*b*d^2*x^2 + a*d^2 -
 6*b)*sin(d*x + c)/d^4
```

### 3.42.9 Mupad [B] (verification not implemented)

Time = 0.17 (sec) , antiderivative size = 73, normalized size of antiderivative = 0.91

$$\int x(a+bx^2)\sin(c+dx)\,dx = \frac{x\,\cos{(c+d\,x)}\,\left(6\,b-a\,d^2\right)}{d^3} - \frac{\sin{(c+d\,x)}\,\left(6\,b-a\,d^2\right)}{d^4} - \frac{b\,x^3\,\cos{(c+d\,x)}}{d} + \frac{3\,b\,x^2\,\sin{(c+d\,x)}}{d^2}$$

input
```
int(x*sin(c + d*x)*(a + b*x^2),x)
```

output
```
(x*cos(c + d*x)*(6*b - a*d^2))/d^3 - (sin(c + d*x)*(6*b - a*d^2))/d^4 - (b
*x^3*cos(c + d*x))/d + (3*b*x^2*sin(c + d*x))/d^2
```

# 3.43 $\int (a+bx^2)\sin(c+dx)\,dx$



## 3.43.1 Optimal result

Integrand size = 14, antiderivative size = 53

$$\int (a+bx^2)\sin(c+dx)\,dx = \frac{2b\cos(c+dx)}{d^3} - \frac{a\cos(c+dx)}{d} - \frac{bx^2\cos(c+dx)}{d} + \frac{2bx\sin(c+dx)}{d^2}$$

output
```
2*b*cos(d*x+c)/d^3-a*cos(d*x+c)/d-b*x^2*cos(d*x+c)/d+2*b*x*sin(d*x+c)/d^2
```

## 3.43.2 Mathematica [A] (verified)

Time = 0.04 (sec) , antiderivative size = 41, normalized size of antiderivative = 0.77

$$\int (a+bx^2)\sin(c+dx)\,dx = \frac{-((ad^2+b(-2+d^2x^2))\cos(c+dx)) + 2bdx\sin(c+dx)}{d^3}$$

input
```
Integrate[(a + b*x^2)*Sin[c + d*x],x]
```

output
```
(-((a*d^2 + b*(-2 + d^2*x^2))*Cos[c + d*x]) + 2*b*d*x*Sin[c + d*x])/d^3
```

### 3.43.3 Rubi [A] (verified)

Time = 0.22 (sec) , antiderivative size = 53, normalized size of antiderivative = 1.00, number of steps used = 2, number of rules used = 2, $\frac{\text{number of rules}}{\text{integrand size}} = 0.143$, Rules used = {3810, 2009}

Below are the steps used by Rubi to obtain the solution. The rule number used for the transformation is given above next to the arrow. The rules definitions used are listed below.

$$\int \left(a+bx^2\right) \sin(c+dx) \, dx$$

$$\Big\downarrow \text{3810}$$

$$\int \left(a \sin(c+dx)+bx^2 \sin(c+dx)\right)dx$$

$$\Big\downarrow \text{2009}$$

$$-\frac{a \cos(c+dx)}{d}+\frac{2b \cos(c+dx)}{d^3}+\frac{2bx \sin(c+dx)}{d^2}-\frac{bx^2 \cos(c+dx)}{d}$$

input
```
Int[(a + b*x^2)*Sin[c + d*x],x]
```

output
```
(2*b*Cos[c + d*x])/d^3 - (a*Cos[c + d*x])/d - (b*x^2*Cos[c + d*x])/d + (2*
b*x*Sin[c + d*x])/d^2
```

#### 3.43.3.1 Defintions of rubi rules used

rule 2009
```
Int[u_, x_Symbol] :> Simp[IntSum[u, x], x] /; SumQ[u]
```

rule 3810
```
Int[((a_) + (b_.)*(x_)^(n_))^(p_.)*Sin[(c_.) + (d_.)*(x_)], x_Symbol] :> In
t[ExpandIntegrand[Sin[c + d*x], (a + b*x^n)^p, x], x] /; FreeQ[{a, b, c, d,
 n}, x] && IGtQ[p, 0]
```

## 3.43.4 Maple [A] (verified)

Time = 0.13 (sec) , antiderivative size = 43, normalized size of antiderivative = 0.81

| method | result |
|---|---|
| risch | $-\frac{(d^2x^2b+a\,d^2-2b)\cos(dx+c)}{d^3}+\frac{2bx\sin(dx+c)}{d^2}$ |
| parallelrisch | $\frac{((-b\,x^2-a)\,d^2+2b)\cos(dx+c)+2\sin(dx+c)bdx+a\,d^2-2b}{d^3}$ |
| parts | $-\frac{b\,x^2\cos(dx+c)}{d}-\frac{a\cos(dx+c)}{d}+\frac{2b(\cos(dx+c)+(dx+c)\sin(dx+c)-c\sin(dx+c))}{d^3}$ |
| norman | $\frac{\frac{b\,x^2\left(\tan^2\left(\frac{dx}{2}+\frac{c}{2}\right)\right)}{d}-\frac{2a\,d^2-4b}{d^3}-\frac{b\,x^2}{d}+\frac{4bx\tan\left(\frac{dx}{2}+\frac{c}{2}\right)}{d^2}}{1+\tan^2\left(\frac{dx}{2}+\frac{c}{2}\right)}$ |
| derivativedivides | $\frac{-a\cos(dx+c)-\frac{b\,c^2\cos(dx+c)}{d^2}-\frac{2bc(\sin(dx+c)-\cos(dx+c)(dx+c))}{d^2}+\frac{b\left(-(dx+c)^2\cos(dx+c)+2\cos(dx+c)+2(dx+c)\sin(dx+c)\right)}{d^2}}{d}$ |
| default | $\frac{-a\cos(dx+c)-\frac{b\,c^2\cos(dx+c)}{d^2}-\frac{2bc(\sin(dx+c)-\cos(dx+c)(dx+c))}{d^2}+\frac{b\left(-(dx+c)^2\cos(dx+c)+2\cos(dx+c)+2(dx+c)\sin(dx+c)\right)}{d^2}}{d}$ |
| meijerg | $\frac{4b\sqrt{\pi}\,\sin(c)\left(\frac{x\left(d^2\right)^{\frac{3}{2}}\cos(dx)}{2\sqrt{\pi}\,d^2}-\frac{\left(d^2\right)^{\frac{3}{2}}\left(-\frac{3d^2x^2}{2}+3\right)\sin(dx)}{6\sqrt{\pi}\,d^3}\right)}{d^2\sqrt{d^2}}+\frac{4b\sqrt{\pi}\,\cos(c)\left(-\frac{1}{2\sqrt{\pi}}+\frac{\left(-\frac{d^2x^2}{2}+1\right)\cos(dx)}{2\sqrt{\pi}}+\frac{dx\sin(dx)}{2\sqrt{\pi}}\right.}{d^3}$ |

input
```
int((b*x^2+a)*sin(d*x+c),x,method=_RETURNVERBOSE)
```

output
```
-(b*d^2*x^2+a*d^2-2*b)/d^3*cos(d*x+c)+2*b*x*sin(d*x+c)/d^2
```

## 3.43.5 Fricas [A] (verification not implemented)

Time = 0.27 (sec) , antiderivative size = 41, normalized size of antiderivative = 0.77

$$\int (a+bx^2)\sin(c+dx)\,dx=\frac{2\,bdx\sin{(dx+c)}-(bd^2x^2+ad^2-2\,b)\cos{(dx+c)}}{d^3}$$

input
```
integrate((b*x^2+a)*sin(d*x+c),x, algorithm="fricas")
```

output
```
(2*b*d*x*sin(d*x + c) - (b*d^2*x^2 + a*d^2 - 2*b)*cos(d*x + c))/d^3
```

### 3.43.6 Sympy [A] (verification not implemented)

Time = 0.19 (sec) , antiderivative size = 65, normalized size of antiderivative = 1.23

$$\int \left(a+bx^2\right)\sin(c+dx)\,dx = \begin{cases} -\frac{a\cos(c+dx)}{d} - \frac{bx^2\cos(c+dx)}{d} + \frac{2bx\sin(c+dx)}{d^2} + \frac{2b\cos(c+dx)}{d^3} & \text{for } d\neq 0 \\ \left(ax+\frac{bx^3}{3}\right)\sin(c) & \text{otherwise} \end{cases}$$

input
```
integrate((b*x**2+a)*sin(d*x+c),x)
```

output
```
Piecewise((-a*cos(c + d*x)/d - b*x**2*cos(c + d*x)/d + 2*b*x*sin(c + d*x)/
d**2 + 2*b*cos(c + d*x)/d**3, Ne(d, 0)), ((a*x + b*x**3/3)*sin(c), True))
```

### 3.43.7 Maxima [A] (verification not implemented)

Time = 0.18 (sec) , antiderivative size = 91, normalized size of antiderivative = 1.72

$$\int \left(a+bx^2\right)\sin(c+dx)\,dx = -\frac{a\cos(dx+c) + \frac{bc^2\cos(dx+c)}{d^2} - \frac{2((dx+c)\cos(dx+c)-\sin(dx+c))bc}{d^2} + \frac{\left(\left((dx+c)^2-2\right)\cos(dx+c)-2(dx+c)\sin(dx+c)\right)b}{d^2}}{d}$$

input
```
integrate((b*x^2+a)*sin(d*x+c),x, algorithm="maxima")
```

output
```
-(a*cos(d*x + c) + b*c^2*cos(d*x + c)/d^2 - 2*((d*x + c)*cos(d*x + c) - si
n(d*x + c))*b*c/d^2 + (((d*x + c)^2 - 2)*cos(d*x + c) - 2*(d*x + c)*sin(d*
x + c))*b/d^2)/d
```

### 3.43.8 Giac [A] (verification not implemented)

Time = 0.29 (sec) , antiderivative size = 42, normalized size of antiderivative = 0.79

$$\int (a+bx^2)\sin(c+dx)\,dx = \frac{2\,bx\sin(dx+c)}{d^2} - \frac{(bd^2x^2+ad^2-2\,b)\cos(dx+c)}{d^3}$$

input
```
integrate((b*x^2+a)*sin(d*x+c),x, algorithm="giac")
```

output
```
2*b*x*sin(d*x + c)/d^2 - (b*d^2*x^2 + a*d^2 - 2*b)*cos(d*x + c)/d^3
```

### 3.43.9 Mupad [B] (verification not implemented)

Time = 5.95 (sec) , antiderivative size = 49, normalized size of antiderivative = 0.92

$$\int (a+bx^2)\sin(c+dx)\,dx = \frac{\cos(c+d\,x)\,\left(2\,b-a\,d^2\right)}{d^3} + \frac{2\,b\,x\,\sin(c+d\,x)}{d^2} - \frac{b\,x^2\,\cos(c+d\,x)}{d}$$

input
```
int(sin(c + d*x)*(a + b*x^2),x)
```

output
```
(cos(c + d*x)*(2*b - a*d^2))/d^3 + (2*b*x*sin(c + d*x))/d^2 - (b*x^2*cos(c
 + d*x))/d
```

# 3.44 $\int \frac{(a+bx^2)\sin(c+dx)}{x}\,dx$



## 3.44.1 Optimal result

Integrand size = 17, antiderivative size = 41

$$\int \frac{(a+bx^2)\sin(c+dx)}{x}\,dx = -\frac{bx\cos(c+dx)}{d} + a\,\text{CosIntegral}(dx)\sin(c) + \frac{b\sin(c+dx)}{d^2} + a\cos(c)\text{Si}(dx)$$

output
```
-b*x*cos(d*x+c)/d+a*cos(c)*Si(d*x)+a*Ci(d*x)*sin(c)+b*sin(d*x+c)/d^2
```

## 3.44.2 Mathematica [A] (verified)

Time = 0.08 (sec) , antiderivative size = 54, normalized size of antiderivative = 1.32

$$\int \frac{(a+bx^2)\sin(c+dx)}{x}\,dx = -\frac{b\cos(dx)(dx\cos(c)-\sin(c))}{d^2} + a\,\text{CosIntegral}(dx)\sin(c) + \frac{b(\cos(c)+dx\sin(c))\sin(dx)}{d^2} + a\cos(c)\text{Si}(dx)$$

input
```
Integrate[((a + b*x^2)*Sin[c + d*x])/x,x]
```

output
```
-((b*Cos[d*x]*(d*x*Cos[c] - Sin[c]))/d^2) + a*CosIntegral[d*x]*Sin[c] + (b
*(Cos[c] + d*x*Sin[c])*Sin[d*x])/d^2 + a*Cos[c]*SinIntegral[d*x]
```

### 3.44.3 Rubi [A] (verified)

Time = 0.24 (sec) , antiderivative size = 41, normalized size of antiderivative = 1.00, number of steps used = 2, number of rules used = 2, $\frac{\text{number of rules}}{\text{integrand size}}$ = 0.118, Rules used = {3820, 2009}

Below are the steps used by Rubi to obtain the solution. The rule number used for the transformation is given above next to the arrow. The rules definitions used are listed below.

$$\int \frac{(a+bx^2)\sin(c+dx)}{x}\,dx$$

$$\Big\downarrow \text{3820}$$

$$\int \left(\frac{a\sin(c+dx)}{x}+bx\sin(c+dx)\right)dx$$

$$\Big\downarrow \text{2009}$$

$$a\sin(c)\,\text{CosIntegral}(dx)+a\cos(c)\text{Si}(dx)+\frac{b\sin(c+dx)}{d^2}-\frac{bx\cos(c+dx)}{d}$$

input
```
Int[((a + b*x^2)*Sin[c + d*x])/x,x]
```

output
```
-((b*x*Cos[c + d*x])/d) + a*CosIntegral[d*x]*Sin[c] + (b*Sin[c + d*x])/d^2
 + a*Cos[c]*SinIntegral[d*x]
```

#### 3.44.3.1 Defintions of rubi rules used

rule 2009
```
Int[u_, x_Symbol] :> Simp[IntSum[u, x], x] /; SumQ[u]
```

rule 3820
```
Int[((e_.)*(x_))^(m_.)*((a_) + (b_.)*(x_)^(n_))^(p_.)*Sin[(c_.) + (d_.)*(x_
)], x_Symbol] :> Int[ExpandIntegrand[Sin[c + d*x], (e*x)^m*(a + b*x^n)^p, x
], x] /; FreeQ[{a, b, c, d, e, m, n}, x] && IGtQ[p, 0]
```

### 3.44.4 Maple [A] (verified)

Time = 0.15 (sec) , antiderivative size = 60, normalized size of antiderivative = 1.46

| method | result |
|---|---|
| derivativedivides | $a(\mathrm{Si}(dx)\cos(c)+\mathrm{Ci}(dx)\sin(c))+\frac{2bc\cos(dx+c)}{d^2}+\frac{(c+1)b(\sin(dx+c)-\cos(dx+c)(dx+c))}{d^2}$ |
| default | $a(\mathrm{Si}(dx)\cos(c)+\mathrm{Ci}(dx)\sin(c))+\frac{2bc\cos(dx+c)}{d^2}+\frac{(c+1)b(\sin(dx+c)-\cos(dx+c)(dx+c))}{d^2}$ |
| risch | $\frac{ia\,\mathrm{e}^{ic}\,\mathrm{Ei}_1(-idx)}{2}-\frac{i\,\mathrm{Ei}_1(-idx)\mathrm{e}^{-ic}a}{2}-\frac{\pi\,\mathrm{csgn}(dx)\mathrm{e}^{-ic}a}{2}+\mathrm{Si}(dx)\,\mathrm{e}^{-ic}a-\frac{bx\cos(dx+c)}{d}+\frac{b\sin(dx+c)}{d^2}$ |
| meijerg | $\frac{2b\sqrt{\pi}\,\sin(c)\left(-\frac{1}{2\sqrt{\pi}}+\frac{\cos(dx)}{2\sqrt{\pi}}+\frac{dx\sin(dx)}{2\sqrt{\pi}}\right)}{d^2}+\frac{2b\sqrt{\pi}\,\cos(c)\left(-\frac{dx\cos(dx)}{2\sqrt{\pi}}+\frac{\sin(dx)}{2\sqrt{\pi}}\right)}{d^2}+\frac{a\sqrt{\pi}\,\sin(c)\left(\frac{2\gamma+2\ln(x)+\ln(d^2)}{\sqrt{\pi}}-\right.}{}$ |

input
```
int((b*x^2+a)*sin(d*x+c)/x,x,method=_RETURNVERBOSE)
```

output
```
a*(Si(d*x)*cos(c)+Ci(d*x)*sin(c))+2/d^2*b*c*cos(d*x+c)+(c+1)/d^2*b*(sin(d*
x+c)-cos(d*x+c)*(d*x+c))
```

### 3.44.5 Fricas [A] (verification not implemented)

Time = 0.27 (sec) , antiderivative size = 46, normalized size of antiderivative = 1.12

$$\int \frac{(a+bx^2)\sin(c+dx)}{x}\,dx = \frac{ad^2\,\mathrm{Ci}(dx)\sin(c)+ad^2\cos(c)\,\mathrm{Si}(dx)-bdx\cos(dx+c)+b\sin(dx+c)}{d^2}$$

input
```
integrate((b*x^2+a)*sin(d*x+c)/x,x, algorithm="fricas")
```

output
```
(a*d^2*cos_integral(d*x)*sin(c) + a*d^2*cos(c)*sin_integral(d*x) - b*d*x*c
os(d*x + c) + b*sin(d*x + c))/d^2
```

### 3.44.6 Sympy [A] (verification not implemented)

Time = 1.87 (sec) , antiderivative size = 65, normalized size of antiderivative = 1.59

$$\int \frac{(a+bx^2)\sin(c+dx)}{x}\,dx = a\sin(c)\operatorname{Ci}(dx) + a\cos(c)\operatorname{Si}(dx) + bx\left(\begin{cases} x\sin(c) & \text{for } d=0 \\ -\frac{\cos(c+dx)}{d} & \text{otherwise} \end{cases}\right) - b\left(\begin{cases} \frac{x^2\sin(c)}{2} & \text{for } d=0 \\ -\frac{\begin{cases} \frac{\sin(c+dx)}{d} & \text{for } d\neq 0 \\ x\cos(c) & \text{otherwise} \end{cases}}{d} & \text{otherwise} \end{cases}\right)$$

input
```
integrate((b*x**2+a)*sin(d*x+c)/x,x)
```

output
```
a*sin(c)*Ci(d*x) + a*cos(c)*Si(d*x) + b*x*Piecewise((x*sin(c), Eq(d, 0)),
(-cos(c + d*x)/d, True)) - b*Piecewise((x**2*sin(c)/2, Eq(d, 0)), (-Piecew
ise((sin(c + d*x)/d, Ne(d, 0)), (x*cos(c), True))/d, True))
```

### 3.44.7 Maxima [C] (verification not implemented)

Result contains complex when optimal does not.

Time = 0.40 (sec) , antiderivative size = 66, normalized size of antiderivative = 1.61

$$\int \frac{(a+bx^2)\sin(c+dx)}{x}\,dx = -\frac{2\,bdx\cos(dx+c) - (a(-i\operatorname{Ei}(i\,dx) + i\operatorname{Ei}(-i\,dx))\cos(c) + a(\operatorname{Ei}(i\,dx) + \operatorname{Ei}(-i\,dx))\sin(c))d^2 - 2\,b\sin(}{2\,d^2}$$

input
```
integrate((b*x^2+a)*sin(d*x+c)/x,x, algorithm="maxima")
```

output
```
-1/2*(2*b*d*x*cos(d*x + c) - (a*(-I*Ei(I*d*x) + I*Ei(-I*d*x))*cos(c) + a*(
Ei(I*d*x) + Ei(-I*d*x))*sin(c))*d^2 - 2*b*sin(d*x + c))/d^2
```

### 3.44.8 Giac [C] (verification not implemented)

Result contains higher order function than in optimal. Order 9 vs. order 4.

Time = 0.32 (sec) , antiderivative size = 432, normalized size of antiderivative = 10.54

$$\int \frac{(a+bx^2)\sin(c+dx)}{x}\,dx = -\frac{ad^2\Im(\mathrm{Ci}\,(dx))\tan\left(\frac{1}{2}\,dx\right)^2\tan\left(\frac{1}{2}\,c\right)^2 - ad^2\Im(\mathrm{Ci}\,(-dx))\tan\left(\frac{1}{2}\,dx\right)^2\tan\left(\frac{1}{2}\,c\right)^2 + 2\,ad^2\,\mathrm{Si}\,(dx)\tan\left(\frac{1}{2}\,dx\right)$$

input
```
integrate((b*x^2+a)*sin(d*x+c)/x,x, algorithm="giac")
```

output
```
-1/2*(a*d^2*imag_part(cos_integral(d*x))*tan(1/2*d*x)^2*tan(1/2*c)^2 - a*d
^2*imag_part(cos_integral(-d*x))*tan(1/2*d*x)^2*tan(1/2*c)^2 + 2*a*d^2*sin
_integral(d*x)*tan(1/2*d*x)^2*tan(1/2*c)^2 - 2*a*d^2*real_part(cos_integra
l(d*x))*tan(1/2*d*x)^2*tan(1/2*c) - 2*a*d^2*real_part(cos_integral(-d*x))*
tan(1/2*d*x)^2*tan(1/2*c) + 2*b*d*x*tan(1/2*d*x)^2*tan(1/2*c)^2 - a*d^2*im
ag_part(cos_integral(d*x))*tan(1/2*d*x)^2 + a*d^2*imag_part(cos_integral(-
d*x))*tan(1/2*d*x)^2 - 2*a*d^2*sin_integral(d*x)*tan(1/2*d*x)^2 + a*d^2*im
ag_part(cos_integral(d*x))*tan(1/2*c)^2 - a*d^2*imag_part(cos_integral(-d*
x))*tan(1/2*c)^2 + 2*a*d^2*sin_integral(d*x)*tan(1/2*c)^2 - 2*b*d*x*tan(1/
2*d*x)^2 - 2*a*d^2*real_part(cos_integral(d*x))*tan(1/2*c) - 2*a*d^2*real_
part(cos_integral(-d*x))*tan(1/2*c) - 8*b*d*x*tan(1/2*d*x)*tan(1/2*c) - 2*
b*d*x*tan(1/2*c)^2 - a*d^2*imag_part(cos_integral(d*x)) + a*d^2*imag_part(
cos_integral(-d*x)) - 2*a*d^2*sin_integral(d*x) + 4*b*tan(1/2*d*x)^2*tan(1
/2*c) + 4*b*tan(1/2*d*x)*tan(1/2*c)^2 + 2*b*d*x - 4*b*tan(1/2*d*x) - 4*b*t
an(1/2*c))/(d^2*tan(1/2*d*x)^2*tan(1/2*c)^2 + d^2*tan(1/2*d*x)^2 + d^2*tan
(1/2*c)^2 + d^2)
```

### 3.44.9 Mupad [F(-1)]

Timed out.

$$\int \frac{(a+bx^2)\sin(c+dx)}{x}\,dx = a\,\mathrm{cosint}(d\,x)\,\sin(c) + a\,\mathrm{sinint}(d\,x)\,\cos(c) + \frac{b\,(\sin(c+d\,x) - d\,x\,\cos(c+d\,x))}{d^2}$$

input
```
int((sin(c + d*x)*(a + b*x^2))/x,x)
```

output
```
a*cosint(d*x)*sin(c) + a*sinint(d*x)*cos(c) + (b*(sin(c + d*x) - d*x*cos(c
 + d*x)))/d^2
```

3.44. $\int \frac{(a+bx^2)\sin(c+dx)}{x}\,dx$

# 3.45 $\int \frac{(a+bx^2)\sin(c+dx)}{x^2} dx$



## 3.45.1 Optimal result

Integrand size = 17, antiderivative size = 44

$$\int \frac{(a+bx^2)\sin(c+dx)}{x^2} dx = -\frac{b\cos(c+dx)}{d} + ad\cos(c)\,\text{CosIntegral}(dx) - \frac{a\sin(c+dx)}{x} - ad\sin(c)\text{Si}(dx)$$

output
```
a*d*Ci(d*x)*cos(c)-b*cos(d*x+c)/d-a*d*Si(d*x)*sin(c)-a*sin(d*x+c)/x
```

## 3.45.2 Mathematica [A] (verified)

Time = 0.06 (sec) , antiderivative size = 44, normalized size of antiderivative = 1.00

$$\int \frac{(a+bx^2)\sin(c+dx)}{x^2} dx = -\frac{b\cos(c+dx)}{d} + ad\cos(c)\,\text{CosIntegral}(dx) - \frac{a\sin(c+dx)}{x} - ad\sin(c)\text{Si}(dx)$$

input
```
Integrate[((a + b*x^2)*Sin[c + d*x])/x^2,x]
```

output
```
-((b*Cos[c + d*x])/d) + a*d*Cos[c]*CosIntegral[d*x] - (a*Sin[c + d*x])/x -
 a*d*Sin[c]*SinIntegral[d*x]
```

### 3.45.3 Rubi [A] (verified)

Time = 0.25 (sec) , antiderivative size = 44, normalized size of antiderivative = 1.00, number of steps used = 2, number of rules used = 2, $\frac{\text{number of rules}}{\text{integrand size}}$ = 0.118, Rules used = {3820, 2009}

Below are the steps used by Rubi to obtain the solution. The rule number used for the transformation is given above next to the arrow. The rules definitions used are listed below.

$$\int \frac{(a+bx^2)\sin(c+dx)}{x^2}\,dx$$

$$\Big\downarrow \text{3820}$$

$$\int \left(\frac{a\sin(c+dx)}{x^2}+b\sin(c+dx)\right)dx$$

$$\Big\downarrow \text{2009}$$

$$ad\cos(c)\,\text{CosIntegral}(dx)-ad\sin(c)\text{Si}(dx)-\frac{a\sin(c+dx)}{x}-\frac{b\cos(c+dx)}{d}$$

input
```
Int[((a + b*x^2)*Sin[c + d*x])/x^2,x]
```

output
```
-((b*Cos[c + d*x])/d) + a*d*Cos[c]*CosIntegral[d*x] - (a*Sin[c + d*x])/x -
 a*d*Sin[c]*SinIntegral[d*x]
```

#### 3.45.3.1 Defintions of rubi rules used

rule 2009
```
Int[u_, x_Symbol] :> Simp[IntSum[u, x], x] /; SumQ[u]
```

rule 3820
```
Int[((e_.)*(x_))^(m_.)*((a_) + (b_.)*(x_)^(n_))^(p_.)*Sin[(c_.) + (d_.)*(x_
)], x_Symbol] :> Int[ExpandIntegrand[Sin[c + d*x], (e*x)^m*(a + b*x^n)^p, x
], x] /; FreeQ[{a, b, c, d, e, m, n}, x] && IGtQ[p, 0]
```

### 3.45.4 Maple [A] (verified)

Time = 0.16 (sec) , antiderivative size = 48, normalized size of antiderivative = 1.09

| method | result |
|---|---|
| derivativedivides | $d\left(a\left(-\frac{\sin(dx+c)}{dx}-\operatorname{Si}(dx)\sin(c)+\operatorname{Ci}(dx)\cos(c)\right)-\frac{b\cos(dx+c)}{d^2}\right)$ |
| default | $d\left(a\left(-\frac{\sin(dx+c)}{dx}-\operatorname{Si}(dx)\sin(c)+\operatorname{Ci}(dx)\cos(c)\right)-\frac{b\cos(dx+c)}{d^2}\right)$ |
| risch | $-\frac{d\cos(c)a\operatorname{Ei}_1(idx)}{2}-\frac{d\cos(c)a\operatorname{Ei}_1(-idx)}{2}+\frac{id\sin(c)a\operatorname{Ei}_1(idx)}{2}-\frac{id\sin(c)a\operatorname{Ei}_1(-idx)}{2}-\frac{b\cos(dx+c)}{d}-\frac{a\,\mathrm{si}}{}$ |
| meijerg | $\frac{b\sin(c)\sin(dx)}{d}+\frac{b\sqrt{\pi}\cos(c)\left(\frac{1}{\sqrt{\pi}}-\frac{\cos(dx)}{\sqrt{\pi}}\right)}{d}+\frac{a\sqrt{\pi}\sin(c)d^2\left(-\frac{4d^2\cos\left(x\sqrt{d^2}\right)}{x(d^2)^{\frac{3}{2}}\sqrt{\pi}}-\frac{4\operatorname{Si}\left(x\sqrt{d^2}\right)}{\sqrt{\pi}}\right)}{4\sqrt{d^2}}+\frac{a\sqrt{\pi}\cos(c)d\left(4\right.}{}$ |

input
```
int((b*x^2+a)*sin(d*x+c)/x^2,x,method=_RETURNVERBOSE)
```

output
```
d*(a*(-sin(d*x+c)/d/x-Si(d*x)*sin(c)+Ci(d*x)*cos(c))-1/d^2*b*cos(d*x+c))
```

### 3.45.5 Fricas [A] (verification not implemented)

Time = 0.28 (sec) , antiderivative size = 53, normalized size of antiderivative = 1.20

$$\int \frac{(a+bx^2)\sin(c+dx)}{x^2}\,dx$$
$$=\frac{ad^2x\cos(c)\operatorname{Ci}(dx)-ad^2x\sin(c)\operatorname{Si}(dx)-bx\cos(dx+c)-ad\sin(dx+c)}{dx}$$

input
```
integrate((b*x^2+a)*sin(d*x+c)/x^2,x, algorithm="fricas")
```

output
```
(a*d^2*x*cos(c)*cos_integral(d*x) - a*d^2*x*sin(c)*sin_integral(d*x) - b*x
*cos(d*x + c) - a*d*sin(d*x + c))/(d*x)
```

### 3.45.6 Sympy [F]

$$\int \frac{(a+bx^2)\sin(c+dx)}{x^2}\,dx = \int \frac{(a+bx^2)\sin{(c+dx)}}{x^2}\,dx$$

input
```
integrate((b*x**2+a)*sin(d*x+c)/x**2,x)
```

output
```
Integral((a + b*x**2)*sin(c + d*x)/x**2, x)
```

### 3.45.7 Maxima [C] (verification not implemented)

Result contains complex when optimal does not.

Time = 0.38 (sec) , antiderivative size = 937, normalized size of antiderivative = 21.30

$$\int \frac{(a+bx^2)\sin(c+dx)}{x^2}\,dx = \text{Too large to display}$$

input
```
integrate((b*x^2+a)*sin(d*x+c)/x^2,x, algorithm="maxima")
```

output
```
-1/4*(((I*exp_integral_e(2, I*d*x) - I*exp_integral_e(2, -I*d*x))*cos(c)^3
 + (I*exp_integral_e(2, I*d*x) - I*exp_integral_e(2, -I*d*x))*cos(c)*sin(c
)^2 + (exp_integral_e(2, I*d*x) + exp_integral_e(2, -I*d*x))*sin(c)^3 + (I
*exp_integral_e(2, I*d*x) - I*exp_integral_e(2, -I*d*x))*cos(c) + ((exp_in
tegral_e(2, I*d*x) + exp_integral_e(2, -I*d*x))*cos(c)^2 + exp_integral_e(
2, I*d*x) + exp_integral_e(2, -I*d*x))*sin(c))*b*c^2/((d*x + c)*(cos(c)^2
+ sin(c)^2)*d^2 - (c*cos(c)^2 + c*sin(c)^2)*d^2) - ((I*exp_integral_e(2, I
*d*x) - I*exp_integral_e(2, -I*d*x))*cos(c)^3 + (I*exp_integral_e(2, I*d*x
) - I*exp_integral_e(2, -I*d*x))*cos(c)*sin(c)^2 + (exp_integral_e(2, I*d*
x) + exp_integral_e(2, -I*d*x))*sin(c)^3 + (I*exp_integral_e(2, I*d*x) - I
*exp_integral_e(2, -I*d*x))*cos(c) + ((exp_integral_e(2, I*d*x) + exp_inte
gral_e(2, -I*d*x))*cos(c)^2 + exp_integral_e(2, I*d*x) + exp_integral_e(2,
 -I*d*x))*sin(c))*a/(c*cos(c)^2 + c*sin(c)^2 - (d*x + c)*(cos(c)^2 + sin(c
)^2)) + 2*(((b*cos(c)^2 + b*sin(c)^2)*(d*x + c)^2 - 2*(b*c*cos(c)^2 + b*c*
sin(c)^2)*(d*x + c))*cos(d*x + c)^3 + (b*c^2*(exp_integral_e(3, I*d*x) + e
xp_integral_e(3, -I*d*x))*cos(c)^3 + b*c^2*(exp_integral_e(3, I*d*x) + exp
_integral_e(3, -I*d*x))*cos(c)*sin(c)^2 + b*c^2*(-I*exp_integral_e(3, I*d*
x) + I*exp_integral_e(3, -I*d*x))*sin(c)^3 + b*c^2*(exp_integral_e(3, I*d*
x) + exp_integral_e(3, -I*d*x))*cos(c) + (b*c^2*(-I*exp_integral_e(3, I*d*
x) + I*exp_integral_e(3, -I*d*x))*cos(c)^2 + b*c^2*(-I*exp_integral_e(3...
```

### 3.45.8 Giac [C] (verification not implemented)

Result contains higher order function than in optimal. Order 9 vs. order 4.

Time = 0.29 (sec) , antiderivative size = 411, normalized size of antiderivative = 9.34

$$\int \frac{(a+bx^2)\sin(c+dx)}{x^2}\,dx =$$
$$-\frac{ad^2x\Re(\mathrm{Ci}\,(dx))\tan\left(\frac{1}{2}\,dx\right)^2\tan\left(\frac{1}{2}\,c\right)^2 + ad^2x\Re(\mathrm{Ci}\,(-dx))\tan\left(\frac{1}{2}\,dx\right)^2\tan\left(\frac{1}{2}\,c\right)^2 + 2\,ad^2x\Im(\mathrm{Ci}\,(dx))\tan}{}$$

input
```
integrate((b*x^2+a)*sin(d*x+c)/x^2,x, algorithm="giac")
```

output
```
-1/2*(a*d^2*x*real_part(cos_integral(d*x))*tan(1/2*d*x)^2*tan(1/2*c)^2 + a
*d^2*x*real_part(cos_integral(-d*x))*tan(1/2*d*x)^2*tan(1/2*c)^2 + 2*a*d^2
*x*imag_part(cos_integral(d*x))*tan(1/2*d*x)^2*tan(1/2*c) - 2*a*d^2*x*imag
_part(cos_integral(-d*x))*tan(1/2*d*x)^2*tan(1/2*c) + 4*a*d^2*x*sin_integr
al(d*x)*tan(1/2*d*x)^2*tan(1/2*c) - a*d^2*x*real_part(cos_integral(d*x))*t
an(1/2*d*x)^2 - a*d^2*x*real_part(cos_integral(-d*x))*tan(1/2*d*x)^2 + a*d
^2*x*real_part(cos_integral(d*x))*tan(1/2*c)^2 + a*d^2*x*real_part(cos_int
egral(-d*x))*tan(1/2*c)^2 + 2*a*d^2*x*imag_part(cos_integral(d*x))*tan(1/2
*c) - 2*a*d^2*x*imag_part(cos_integral(-d*x))*tan(1/2*c) + 4*a*d^2*x*sin_i
ntegral(d*x)*tan(1/2*c) + 2*b*x*tan(1/2*d*x)^2*tan(1/2*c)^2 - a*d^2*x*real
_part(cos_integral(d*x)) - a*d^2*x*real_part(cos_integral(-d*x)) - 4*a*d*t
an(1/2*d*x)^2*tan(1/2*c) - 4*a*d*tan(1/2*d*x)*tan(1/2*c)^2 - 2*b*x*tan(1/2
*d*x)^2 - 8*b*x*tan(1/2*d*x)*tan(1/2*c) - 2*b*x*tan(1/2*c)^2 + 4*a*d*tan(1
/2*d*x) + 4*a*d*tan(1/2*c) + 2*b*x)/(d*x*tan(1/2*d*x)^2*tan(1/2*c)^2 + d*x
*tan(1/2*d*x)^2 + d*x*tan(1/2*c)^2 + d*x)
```

### 3.45.9 Mupad [F(-1)]

Timed out.

$$\int \frac{(a+bx^2)\sin(c+dx)}{x^2}\,dx = \int \frac{\sin(c+d\,x)\,(b\,x^2+a)}{x^2}\,dx$$

input
```
int((sin(c + d*x)*(a + b*x^2))/x^2,x)
```

output
```
int((sin(c + d*x)*(a + b*x^2))/x^2, x)
```

# 3.46 $\int \frac{(a+bx^2)\sin(c+dx)}{x^3}\,dx$



## 3.46.1 Optimal result

Integrand size = 17, antiderivative size = 74

$$\int \frac{(a+bx^2)\sin(c+dx)}{x^3}\,dx = -\frac{ad\cos(c+dx)}{2x} + b\,\text{CosIntegral}(dx)\sin(c) - \frac{1}{2}ad^2\,\text{CosIntegral}(dx)\sin(c) - \frac{a\sin(c+dx)}{2x^2} + b\cos(c)\text{Si}(dx) - \frac{1}{2}ad^2\cos(c)\text{Si}(dx)$$

output
```
-1/2*a*d*cos(d*x+c)/x+b*cos(c)*Si(d*x)-1/2*a*d^2*cos(c)*Si(d*x)+b*Ci(d*x)*
sin(c)-1/2*a*d^2*Ci(d*x)*sin(c)-1/2*a*sin(d*x+c)/x^2
```

## 3.46.2 Mathematica [A] (verified)

Time = 0.11 (sec) , antiderivative size = 82, normalized size of antiderivative = 1.11

$$\int \frac{(a+bx^2)\sin(c+dx)}{x^3}\,dx = b\,\text{CosIntegral}(dx)\sin(c) - \frac{a\cos(dx)(dx\cos(c)+\sin(c))}{2x^2} + \frac{a(-\cos(c)+dx\sin(c))\sin(dx)}{2x^2} + b\cos(c)\text{Si}(dx) - \frac{1}{2}ad^2(\text{CosIntegral}(dx)\sin(c)+\cos(c)\text{Si}(dx))$$

input
```
Integrate[((a + b*x^2)*Sin[c + d*x])/x^3,x]
```

output
```
b*CosIntegral[d*x]*Sin[c] - (a*Cos[d*x]*(d*x*Cos[c] + Sin[c]))/(2*x^2) + (
a*(-Cos[c] + d*x*Sin[c])*Sin[d*x])/(2*x^2) + b*Cos[c]*SinIntegral[d*x] - (
a*d^2*(CosIntegral[d*x]*Sin[c] + Cos[c]*SinIntegral[d*x]))/2
```

### 3.46.3 Rubi [A] (verified)

Time = 0.31 (sec) , antiderivative size = 74, normalized size of antiderivative = 1.00, number of steps used = 2, number of rules used = 2, $\frac{\text{number of rules}}{\text{integrand size}}$ = 0.118, Rules used = {3820, 2009}

Below are the steps used by Rubi to obtain the solution. The rule number used for the transformation is given above next to the arrow. The rules definitions used are listed below.

$$\int \frac{(a+bx^2)\sin(c+dx)}{x^3}\,dx$$

$$\Big\downarrow \; 3820$$

$$\int \left(\frac{a\sin(c+dx)}{x^3}+\frac{b\sin(c+dx)}{x}\right)dx$$

$$\Big\downarrow \; 2009$$

$$-\frac{1}{2}ad^2\sin(c)\,\text{CosIntegral}(dx)-\frac{1}{2}ad^2\cos(c)\text{Si}(dx)-\frac{a\sin(c+dx)}{2x^2}-\frac{ad\cos(c+dx)}{2x}+b\sin(c)\,\text{CosIntegral}(dx)+b\cos(c)\text{Si}(dx)$$

input
```
Int[((a + b*x^2)*Sin[c + d*x])/x^3,x]
```

output
```
-1/2*(a*d*Cos[c + d*x])/x + b*CosIntegral[d*x]*Sin[c] - (a*d^2*CosIntegral
[d*x]*Sin[c])/2 - (a*Sin[c + d*x])/(2*x^2) + b*Cos[c]*SinIntegral[d*x] - (
a*d^2*Cos[c]*SinIntegral[d*x])/2
```

#### 3.46.3.1 Defintions of rubi rules used

rule 2009
```
Int[u_, x_Symbol] :> Simp[IntSum[u, x], x] /; SumQ[u]
```

rule 3820
```
Int[((e_.)*(x_))^(m_.)*((a_) + (b_.)*(x_)^(n_))^(p_.)*Sin[(c_.) + (d_.)*(x_
)], x_Symbol] :> Int[ExpandIntegrand[Sin[c + d*x], (e*x)^m*(a + b*x^n)^p, x
], x] /; FreeQ[{a, b, c, d, e, m, n}, x] && IGtQ[p, 0]
```

### 3.46.4 Maple [A] (verified)

Time = 0.17 (sec) , antiderivative size = 73, normalized size of antiderivative = 0.99

| method | result |
|---|---|
| derivativedivides | $d^2\left(a\left(-\frac{\sin(dx+c)}{2d^2x^2}-\frac{\cos(dx+c)}{2dx}-\frac{\mathrm{Si}(dx)\cos(c)}{2}-\frac{\mathrm{Ci}(dx)\sin(c)}{2}\right)+\frac{b(\mathrm{Si}(dx)\cos(c)+\mathrm{Ci}(dx)\sin(c))}{d^2}\right)$ |
| default | $d^2\left(a\left(-\frac{\sin(dx+c)}{2d^2x^2}-\frac{\cos(dx+c)}{2dx}-\frac{\mathrm{Si}(dx)\cos(c)}{2}-\frac{\mathrm{Ci}(dx)\sin(c)}{2}\right)+\frac{b(\mathrm{Si}(dx)\cos(c)+\mathrm{Ci}(dx)\sin(c))}{d^2}\right)$ |
| risch | $\frac{i\cos(c)\,\mathrm{Ei}_1(idx)a\,d^2}{4}-\frac{i\cos(c)\,\mathrm{Ei}_1(-idx)a\,d^2}{4}-\frac{i\cos(c)\,\mathrm{Ei}_1(idx)b}{2}+\frac{i\cos(c)\,\mathrm{Ei}_1(-idx)b}{2}+\frac{\sin(c)\,\mathrm{Ei}_1(idx)a\,d^2}{4}+$ |
| meijerg | $\frac{b\sqrt{\pi}\,\sin(c)\left(\frac{2\gamma+2\ln(x)+\ln\left(d^2\right)}{\sqrt{\pi}}-\frac{2\gamma}{\sqrt{\pi}}-\frac{2\ln(2)}{\sqrt{\pi}}-\frac{2\ln\left(\frac{dx}{2}\right)}{\sqrt{\pi}}+\frac{2\,\mathrm{Ci}(dx)}{\sqrt{\pi}}\right)}{2}+b\cos(c)\,\mathrm{Si}(dx)+\frac{a\sqrt{\pi}\,\sin(c)d^2\left(-\frac{4}{\sqrt{\pi}\,x^2}\right.}{}$ |

input
```
int((b*x^2+a)*sin(d*x+c)/x^3,x,method=_RETURNVERBOSE)
```

output
```
d^2*(a*(-1/2*sin(d*x+c)/d^2/x^2-1/2*cos(d*x+c)/d/x-1/2*Si(d*x)*cos(c)-1/2*
Ci(d*x)*sin(c))+1/d^2*b*(Si(d*x)*cos(c)+Ci(d*x)*sin(c)))
```

### 3.46.5 Fricas [A] (verification not implemented)

Time = 0.28 (sec) , antiderivative size = 62, normalized size of antiderivative = 0.84

$$\int \frac{(a+bx^2)\sin(c+dx)}{x^3}\,dx = -\frac{(ad^2-2\,b)x^2\,\mathrm{Ci}\,(dx)\sin\,(c)+(ad^2-2\,b)x^2\cos\,(c)\,\mathrm{Si}\,(dx)+adx\cos\,(dx+c)+a\sin\,(dx+c)}{2\,x^2}$$

input
```
integrate((b*x^2+a)*sin(d*x+c)/x^3,x, algorithm="fricas")
```

output
```
-1/2*((a*d^2 - 2*b)*x^2*cos_integral(d*x)*sin(c) + (a*d^2 - 2*b)*x^2*cos(c
)*sin_integral(d*x) + a*d*x*cos(d*x + c) + a*sin(d*x + c))/x^2
```

### 3.46.6 Sympy [F]

$$\int \frac{(a+bx^2)\sin(c+dx)}{x^3}\,dx = \int \frac{(a+bx^2)\sin{(c+dx)}}{x^3}\,dx$$

input
```
integrate((b*x**2+a)*sin(d*x+c)/x**3,x)
```

output
```
Integral((a + b*x**2)*sin(c + d*x)/x**3, x)
```

### 3.46.7 Maxima [C] (verification not implemented)

Result contains complex when optimal does not.

Time = 0.65 (sec) , antiderivative size = 123, normalized size of antiderivative = 1.66

$$\int \frac{(a+bx^2)\sin(c+dx)}{x^3}\,dx = -\frac{2\,bdx\cos{(dx+c)} + ((a(-i\,\Gamma(-2,i\,dx)+i\,\Gamma(-2,-i\,dx))\cos{(c)} - a(\Gamma(-2,i\,dx)+\Gamma(-2,-i\,dx))\sin{(c}}{}$$

input
```
integrate((b*x^2+a)*sin(d*x+c)/x^3,x, algorithm="maxima")
```

output
```
-1/2*(2*b*d*x*cos(d*x + c) + ((a*(-I*gamma(-2, I*d*x) + I*gamma(-2, -I*d*x
))*cos(c) - a*(gamma(-2, I*d*x) + gamma(-2, -I*d*x))*sin(c))*d^4 - 2*(b*(-
I*gamma(-2, I*d*x) + I*gamma(-2, -I*d*x))*cos(c) - b*(gamma(-2, I*d*x) + g
amma(-2, -I*d*x))*sin(c))*d^2)*x^2 + 2*b*sin(d*x + c))/(d^2*x^2)
```

### 3.46.8 Giac [C] (verification not implemented)

Result contains higher order function than in optimal. Order 9 vs. order 4.

Time = 0.29 (sec) , antiderivative size = 766, normalized size of antiderivative = 10.35

$$\int \frac{(a+bx^2)\sin(c+dx)}{x^3}\,dx = \text{Too large to display}$$

input
```
integrate((b*x^2+a)*sin(d*x+c)/x^3,x, algorithm="giac")
```

output
```
1/4*(a*d^2*x^2*imag_part(cos_integral(d*x))*tan(1/2*d*x)^2*tan(1/2*c)^2 -
a*d^2*x^2*imag_part(cos_integral(-d*x))*tan(1/2*d*x)^2*tan(1/2*c)^2 + 2*a*
d^2*x^2*sin_integral(d*x)*tan(1/2*d*x)^2*tan(1/2*c)^2 - 2*a*d^2*x^2*real_p
art(cos_integral(d*x))*tan(1/2*d*x)^2*tan(1/2*c) - 2*a*d^2*x^2*real_part(c
os_integral(-d*x))*tan(1/2*d*x)^2*tan(1/2*c) - a*d^2*x^2*imag_part(cos_int
egral(d*x))*tan(1/2*d*x)^2 + a*d^2*x^2*imag_part(cos_integral(-d*x))*tan(1
/2*d*x)^2 - 2*a*d^2*x^2*sin_integral(d*x)*tan(1/2*d*x)^2 + a*d^2*x^2*imag_
part(cos_integral(d*x))*tan(1/2*c)^2 - a*d^2*x^2*imag_part(cos_integral(-d
*x))*tan(1/2*c)^2 + 2*a*d^2*x^2*sin_integral(d*x)*tan(1/2*c)^2 - 2*b*x^2*i
mag_part(cos_integral(d*x))*tan(1/2*d*x)^2*tan(1/2*c)^2 + 2*b*x^2*imag_par
t(cos_integral(-d*x))*tan(1/2*d*x)^2*tan(1/2*c)^2 - 4*b*x^2*sin_integral(d
*x)*tan(1/2*d*x)^2*tan(1/2*c)^2 - 2*a*d^2*x^2*real_part(cos_integral(d*x))
*tan(1/2*c) - 2*a*d^2*x^2*real_part(cos_integral(-d*x))*tan(1/2*c) + 4*b*x
^2*real_part(cos_integral(d*x))*tan(1/2*d*x)^2*tan(1/2*c) + 4*b*x^2*real_p
art(cos_integral(-d*x))*tan(1/2*d*x)^2*tan(1/2*c) - 2*a*d*x*tan(1/2*d*x)^2
*tan(1/2*c)^2 - a*d^2*x^2*imag_part(cos_integral(d*x)) + a*d^2*x^2*imag_pa
rt(cos_integral(-d*x)) - 2*a*d^2*x^2*sin_integral(d*x) + 2*b*x^2*imag_part
(cos_integral(d*x))*tan(1/2*d*x)^2 - 2*b*x^2*imag_part(cos_integral(-d*x))
*tan(1/2*d*x)^2 + 4*b*x^2*sin_integral(d*x)*tan(1/2*d*x)^2 - 2*b*x^2*imag_
part(cos_integral(d*x))*tan(1/2*c)^2 + 2*b*x^2*imag_part(cos_integral(-...
```

### 3.46.9 Mupad [F(-1)]

Timed out.

$$\int \frac{(a+bx^2)\sin(c+dx)}{x^3}\,dx = \int \frac{\sin(c+d\,x)\,\left(b\,x^2+a\right)}{x^3}\,dx$$

input
```
int((sin(c + d*x)*(a + b*x^2))/x^3,x)
```

output
```
int((sin(c + d*x)*(a + b*x^2))/x^3, x)
```

# 3.47 $\int \frac{(a+bx^2)\sin(c+dx)}{x^4}\,dx$



## 3.47.1 Optimal result

Integrand size = 17, antiderivative size = 106

$$\begin{aligned}\int \frac{(a+bx^2)\sin(c+dx)}{x^4}\,dx = & -\frac{ad\cos(c+dx)}{6x^2}+bd\cos(c)\,\text{CosIntegral}(dx)\\ & -\frac{1}{6}ad^3\cos(c)\,\text{CosIntegral}(dx)-\frac{a\sin(c+dx)}{3x^3}-\frac{b\sin(c+dx)}{x}\\ & +\frac{ad^2\sin(c+dx)}{6x}-bd\sin(c)\text{Si}(dx)+\frac{1}{6}ad^3\sin(c)\text{Si}(dx)\end{aligned}$$

output
```
b*d*Ci(d*x)*cos(c)-1/6*a*d^3*Ci(d*x)*cos(c)-1/6*a*d*cos(d*x+c)/x^2-b*d*Si(
d*x)*sin(c)+1/6*a*d^3*Si(d*x)*sin(c)-1/3*a*sin(d*x+c)/x^3-b*sin(d*x+c)/x+1
/6*a*d^2*sin(d*x+c)/x
```

## 3.47.2 Mathematica [A] (verified)

Time = 0.10 (sec) , antiderivative size = 95, normalized size of antiderivative = 0.90

$$\begin{aligned}&\int \frac{(a+bx^2)\sin(c+dx)}{x^4}\,dx\\ &=\frac{-adx\cos(c+dx)+d(6b-ad^2)\,x^3\cos(c)\,\text{CosIntegral}(dx)-2a\sin(c+dx)-6bx^2\sin(c+dx)+ad^2x^2\sin}{6x^3}\end{aligned}$$

input
```
Integrate[((a + b*x^2)*Sin[c + d*x])/x^4,x]
```

output
```
(-(a*d*x*Cos[c + d*x]) + d*(6*b - a*d^2)*x^3*Cos[c]*CosIntegral[d*x] - 2*a
*Sin[c + d*x] - 6*b*x^2*Sin[c + d*x] + a*d^2*x^2*Sin[c + d*x] + d*(-6*b +
a*d^2)*x^3*Sin[c]*SinIntegral[d*x])/(6*x^3)
```

### 3.47.3 Rubi [A] (verified)

Time = 0.36 (sec) , antiderivative size = 106, normalized size of antiderivative = 1.00, number of steps used = 2, number of rules used = 2, $\frac{\text{number of rules}}{\text{integrand size}} = 0.118$, Rules used = {3820, 2009}

Below are the steps used by Rubi to obtain the solution. The rule number used for the transformation is given above next to the arrow. The rules definitions used are listed below.

$$\int \frac{(a+bx^2)\sin(c+dx)}{x^4}\,dx$$

$$\Big\downarrow \text{3820}$$

$$\int \left(\frac{a\sin(c+dx)}{x^4}+\frac{b\sin(c+dx)}{x^2}\right)dx$$

$$\Big\downarrow \text{2009}$$

$$-\frac{1}{6}ad^3\cos(c)\operatorname{CosIntegral}(dx)+\frac{1}{6}ad^3\sin(c)\operatorname{Si}(dx)+\frac{ad^2\sin(c+dx)}{6x}-\frac{a\sin(c+dx)}{3x^3}-\frac{ad\cos(c+dx)}{6x^2}+bd\cos(c)\operatorname{CosIntegral}(dx)-bd\sin(c)\operatorname{Si}(dx)-\frac{b\sin(c+dx)}{x}$$

input
```
Int[((a + b*x^2)*Sin[c + d*x])/x^4,x]
```

output
```
-1/6*(a*d*Cos[c + d*x])/x^2 + b*d*Cos[c]*CosIntegral[d*x] - (a*d^3*Cos[c]*
CosIntegral[d*x])/6 - (a*Sin[c + d*x])/(3*x^3) - (b*Sin[c + d*x])/x + (a*d
^2*Sin[c + d*x])/(6*x) - b*d*Sin[c]*SinIntegral[d*x] + (a*d^3*Sin[c]*SinIn
tegral[d*x])/6
```

#### 3.47.3.1 Defintions of rubi rules used

rule 2009
```
Int[u_, x_Symbol] :> Simp[IntSum[u, x], x] /; SumQ[u]
```

rule 3820
```
Int[((e_.)*(x_))^(m_.)*((a_) + (b_.)*(x_)^(n_))^(p_.)*Sin[(c_.) + (d_.)*(x_
)], x_Symbol] :> Int[ExpandIntegrand[Sin[c + d*x], (e*x)^m*(a + b*x^n)^p, x
], x] /; FreeQ[{a, b, c, d, e, m, n}, x] && IGtQ[p, 0]
```

## 3.47.4 Maple [A] (verified)

Time = 0.20 (sec) , antiderivative size = 102, normalized size of antiderivative = 0.96

| method | result |
|---|---|
| derivativedivides | $d^3\left(a\left(-\frac{\sin(dx+c)}{3d^3x^3}-\frac{\cos(dx+c)}{6d^2x^2}+\frac{\sin(dx+c)}{6dx}+\frac{\operatorname{Si}(dx)\sin(c)}{6}-\frac{\operatorname{Ci}(dx)\cos(c)}{6}\right)+\frac{b\left(-\frac{\sin(dx+c)}{dx}-\operatorname{Si}(dx)\sin\right.}{d^2}\right.$ |
| default | $d^3\left(a\left(-\frac{\sin(dx+c)}{3d^3x^3}-\frac{\cos(dx+c)}{6d^2x^2}+\frac{\sin(dx+c)}{6dx}+\frac{\operatorname{Si}(dx)\sin(c)}{6}-\frac{\operatorname{Ci}(dx)\cos(c)}{6}\right)+\frac{b\left(-\frac{\sin(dx+c)}{dx}-\operatorname{Si}(dx)\sin\right.}{d^2}\right.$ |
| risch | $\frac{\cos(c)\operatorname{Ei}_1(idx)a\,d^3}{12}+\frac{\cos(c)\operatorname{Ei}_1(-idx)a\,d^3}{12}-\frac{\cos(c)\operatorname{Ei}_1(idx)bd}{2}-\frac{\cos(c)\operatorname{Ei}_1(-idx)bd}{2}-\frac{i\sin(c)\operatorname{Ei}_1(idx)a\,d^3}{12}+$ |
| meijerg | $\frac{d^2b\sqrt{\pi}\,\sin(c)\left(-\frac{4d^2\cos\left(x\sqrt{d^2}\right)}{x\left(d^2\right)^{\frac{3}{2}}\sqrt{\pi}}-\frac{4\operatorname{Si}\left(x\sqrt{d^2}\right)}{\sqrt{\pi}}\right)}{4\sqrt{d^2}}+\frac{db\sqrt{\pi}\,\cos(c)\left(\frac{4\gamma-4+4\ln(x)+4\ln(d)}{\sqrt{\pi}}+\frac{4}{\sqrt{\pi}}-\frac{4\gamma}{\sqrt{\pi}}-\frac{4\ln(2)}{\sqrt{\pi}}-\frac{4\ln\left(\frac{dx}{2}\right)}{\sqrt{\pi}}-\right.}{4}$ |

input
```
int((b*x^2+a)*sin(d*x+c)/x^4,x,method=_RETURNVERBOSE)
```

output
```
d^3*(a*(-1/3*sin(d*x+c)/d^3/x^3-1/6*cos(d*x+c)/d^2/x^2+1/6*sin(d*x+c)/d/x+
1/6*Si(d*x)*sin(c)-1/6*Ci(d*x)*cos(c))+1/d^2*b*(-sin(d*x+c)/d/x-Si(d*x)*si
n(c)+Ci(d*x)*cos(c)))
```

## 3.47.5 Fricas [A] (verification not implemented)

Time = 0.27 (sec) , antiderivative size = 82, normalized size of antiderivative = 0.77

$$\int\frac{(a+bx^2)\sin(c+dx)}{x^4}\,dx = -\frac{(ad^3-6\,bd)x^3\cos{(c)}\operatorname{Ci}{(dx)}-(ad^3-6\,bd)x^3\sin{(c)}\operatorname{Si}{(dx)}+adx\cos{(dx+c)}-((ad^2-6\,b)x^2-2\,a)}{6\,x^3}$$

input
```
integrate((b*x^2+a)*sin(d*x+c)/x^4,x, algorithm="fricas")
```

output
```
-1/6*((a*d^3 - 6*b*d)*x^3*cos(c)*cos_integral(d*x) - (a*d^3 - 6*b*d)*x^3*s
in(c)*sin_integral(d*x) + a*d*x*cos(d*x + c) - ((a*d^2 - 6*b)*x^2 - 2*a)*s
in(d*x + c))/x^3
```

### 3.47.6 Sympy [F]

$$\int \frac{(a+bx^2)\sin(c+dx)}{x^4}\,dx = \int \frac{(a+bx^2)\sin{(c+dx)}}{x^4}\,dx$$

input
```
integrate((b*x**2+a)*sin(d*x+c)/x**4,x)
```

output
```
Integral((a + b*x**2)*sin(c + d*x)/x**4, x)
```

### 3.47.7 Maxima [C] (verification not implemented)

Result contains complex when optimal does not.

Time = 0.72 (sec) , antiderivative size = 121, normalized size of antiderivative = 1.14

$$\int \frac{(a+bx^2)\sin(c+dx)}{x^4}\,dx =$$
$$-\frac{((a(\Gamma(-3,i\,dx)+\Gamma(-3,-i\,dx))\cos{(c)}+a(-i\,\Gamma(-3,i\,dx)+i\,\Gamma(-3,-i\,dx))\sin{(c)})d^5-6\,(b(\Gamma(-3,i\,d}{}$$

input
```
integrate((b*x^2+a)*sin(d*x+c)/x^4,x, algorithm="maxima")
```

output
```
-1/2*(((a*(gamma(-3, I*d*x) + gamma(-3, -I*d*x))*cos(c) + a*(-I*gamma(-3,
I*d*x) + I*gamma(-3, -I*d*x))*sin(c))*d^5 - 6*(b*(gamma(-3, I*d*x) + gamma
(-3, -I*d*x))*cos(c) + b*(-I*gamma(-3, I*d*x) + I*gamma(-3, -I*d*x))*sin(c
))*d^3)*x^3 + 2*b*d*x*cos(d*x + c) + 4*b*sin(d*x + c))/(d^2*x^3)
```

### 3.47.8 Giac [C] (verification not implemented)

Result contains higher order function than in optimal. Order 9 vs. order 4.

Time = 0.31 (sec) , antiderivative size = 834, normalized size of antiderivative = 7.87

$$\int \frac{(a+bx^2)\sin(c+dx)}{x^4}\,dx = \text{Too large to display}$$

input
```
integrate((b*x^2+a)*sin(d*x+c)/x^4,x, algorithm="giac")
```

output
```
1/12*(a*d^3*x^3*real_part(cos_integral(d*x))*tan(1/2*d*x)^2*tan(1/2*c)^2 +
 a*d^3*x^3*real_part(cos_integral(-d*x))*tan(1/2*d*x)^2*tan(1/2*c)^2 + 2*a
*d^3*x^3*imag_part(cos_integral(d*x))*tan(1/2*d*x)^2*tan(1/2*c) - 2*a*d^3*
x^3*imag_part(cos_integral(-d*x))*tan(1/2*d*x)^2*tan(1/2*c) + 4*a*d^3*x^3*
sin_integral(d*x)*tan(1/2*d*x)^2*tan(1/2*c) - a*d^3*x^3*real_part(cos_inte
gral(d*x))*tan(1/2*d*x)^2 - a*d^3*x^3*real_part(cos_integral(-d*x))*tan(1/
2*d*x)^2 + a*d^3*x^3*real_part(cos_integral(d*x))*tan(1/2*c)^2 + a*d^3*x^3
*real_part(cos_integral(-d*x))*tan(1/2*c)^2 - 6*b*d*x^3*real_part(cos_inte
gral(d*x))*tan(1/2*d*x)^2*tan(1/2*c)^2 - 6*b*d*x^3*real_part(cos_integral(
-d*x))*tan(1/2*d*x)^2*tan(1/2*c)^2 + 2*a*d^3*x^3*imag_part(cos_integral(d*
x))*tan(1/2*c) - 2*a*d^3*x^3*imag_part(cos_integral(-d*x))*tan(1/2*c) + 4*
a*d^3*x^3*sin_integral(d*x)*tan(1/2*c) - 12*b*d*x^3*imag_part(cos_integral
(d*x))*tan(1/2*d*x)^2*tan(1/2*c) + 12*b*d*x^3*imag_part(cos_integral(-d*x)
)*tan(1/2*d*x)^2*tan(1/2*c) - 24*b*d*x^3*sin_integral(d*x)*tan(1/2*d*x)^2*
tan(1/2*c) - a*d^3*x^3*real_part(cos_integral(d*x)) - a*d^3*x^3*real_part(
cos_integral(-d*x)) + 6*b*d*x^3*real_part(cos_integral(d*x))*tan(1/2*d*x)^
2 + 6*b*d*x^3*real_part(cos_integral(-d*x))*tan(1/2*d*x)^2 - 4*a*d^2*x^2*t
an(1/2*d*x)^2*tan(1/2*c) - 6*b*d*x^3*real_part(cos_integral(d*x))*tan(1/2*
c)^2 - 6*b*d*x^3*real_part(cos_integral(-d*x))*tan(1/2*c)^2 - 4*a*d^2*x^2*
tan(1/2*d*x)*tan(1/2*c)^2 - 12*b*d*x^3*imag_part(cos_integral(d*x))*tan...
```

### 3.47.9 Mupad [F(-1)]

Timed out.

$$\int \frac{(a+bx^2)\sin(c+dx)}{x^4}\,dx = \int \frac{\sin(c+d\,x)\,\left(b\,x^2+a\right)}{x^4}\,dx$$

input
```
int((sin(c + d*x)*(a + b*x^2))/x^4,x)
```

output
```
int((sin(c + d*x)*(a + b*x^2))/x^4, x)
```

# 3.48 $\int \frac{(a+bx^2)\sin(c+dx)}{x^5}\,dx$



## 3.48.1 Optimal result

Integrand size = 17, antiderivative size = 149

$$\begin{aligned}\int \frac{(a+bx^2)\sin(c+dx)}{x^5}\,dx = &-\frac{ad\cos(c+dx)}{12x^3}-\frac{bd\cos(c+dx)}{2x}+\frac{ad^3\cos(c+dx)}{24x}\\ &-\frac{1}{2}bd^2\,\text{CosIntegral}(dx)\sin(c)+\frac{1}{24}ad^4\,\text{CosIntegral}(dx)\sin(c)\\ &-\frac{a\sin(c+dx)}{4x^4}-\frac{b\sin(c+dx)}{2x^2}+\frac{ad^2\sin(c+dx)}{24x^2}\\ &-\frac{1}{2}bd^2\cos(c)\text{Si}(dx)+\frac{1}{24}ad^4\cos(c)\text{Si}(dx)\end{aligned}$$

output
```
-1/12*a*d*cos(d*x+c)/x^3-1/2*b*d*cos(d*x+c)/x+1/24*a*d^3*cos(d*x+c)/x-1/2*
b*d^2*cos(c)*Si(d*x)+1/24*a*d^4*cos(c)*Si(d*x)-1/2*b*d^2*Ci(d*x)*sin(c)+1/
24*a*d^4*Ci(d*x)*sin(c)-1/4*a*sin(d*x+c)/x^4-1/2*b*sin(d*x+c)/x^2+1/24*a*d
^2*sin(d*x+c)/x^2
```

## 3.48.2 Mathematica [A] (verified)

Time = 0.12 (sec) , antiderivative size = 125, normalized size of antiderivative = 0.84

$$\int \frac{(a+bx^2)\sin(c+dx)}{x^5}\,dx$$
$$= \frac{-2adx\cos(c+dx)-12bdx^3\cos(c+dx)+ad^3x^3\cos(c+dx)+d^2(-12b+ad^2)\,x^4\,\text{CosIntegral}(dx)\sin(c)}{24x^4}$$

input
```
Integrate[((a + b*x^2)*Sin[c + d*x])/x^5,x]
```

output
```
(-2*a*d*x*Cos[c + d*x] - 12*b*d*x^3*Cos[c + d*x] + a*d^3*x^3*Cos[c + d*x]
+ d^2*(-12*b + a*d^2)*x^4*CosIntegral[d*x]*Sin[c] - 6*a*Sin[c + d*x] - 12*
b*x^2*Sin[c + d*x] + a*d^2*x^2*Sin[c + d*x] + d^2*(-12*b + a*d^2)*x^4*Cos[
c]*SinIntegral[d*x])/(24*x^4)
```

### 3.48.3 Rubi [A] (verified)

Time = 0.41 (sec) , antiderivative size = 149, normalized size of antiderivative = 1.00, number of steps used = 2, number of rules used = 2, $\frac{\text{number of rules}}{\text{integrand size}} = 0.118$, Rules used = {3820, 2009}

Below are the steps used by Rubi to obtain the solution. The rule number used for the transformation is given above next to the arrow. The rules definitions used are listed below.

$$\int \frac{(a+bx^2)\sin(c+dx)}{x^5}\,dx$$

$$\Big\downarrow \text{3820}$$

$$\int \left(\frac{a\sin(c+dx)}{x^5}+\frac{b\sin(c+dx)}{x^3}\right)dx$$

$$\Big\downarrow \text{2009}$$

$$\frac{1}{24}ad^4\sin(c)\,\text{CosIntegral}(dx)+\frac{1}{24}ad^4\cos(c)\text{Si}(dx)+\frac{ad^3\cos(c+dx)}{24x}+\frac{ad^2\sin(c+dx)}{24x^2}-\frac{a\sin(c+dx)}{4x^4}-\frac{ad\cos(c+dx)}{12x^3}-\frac{1}{2}bd^2\sin(c)\,\text{CosIntegral}(dx)-\frac{1}{2}bd^2\cos(c)\text{Si}(dx)-\frac{b\sin(c+dx)}{2x^2}-\frac{bd\cos(c+dx)}{2x}$$

input
```
Int[((a + b*x^2)*Sin[c + d*x])/x^5,x]
```

output
```
-1/12*(a*d*Cos[c + d*x])/x^3 - (b*d*Cos[c + d*x])/(2*x) + (a*d^3*Cos[c + d
*x])/(24*x) - (b*d^2*CosIntegral[d*x]*Sin[c])/2 + (a*d^4*CosIntegral[d*x]*
Sin[c])/24 - (a*Sin[c + d*x])/(4*x^4) - (b*Sin[c + d*x])/(2*x^2) + (a*d^2*
Sin[c + d*x])/(24*x^2) - (b*d^2*Cos[c]*SinIntegral[d*x])/2 + (a*d^4*Cos[c]
*SinIntegral[d*x])/24
```

#### 3.48.3.1 Defintions of rubi rules used

rule 2009
```
Int[u_, x_Symbol] :> Simp[IntSum[u, x], x] /; SumQ[u]
```

rule 3820
```
Int[((e_.)*(x_))^(m_.)*((a_) + (b_.)*(x_)^(n_))^(p_.)*Sin[(c_.) + (d_.)*(x_
)], x_Symbol] :> Int[ExpandIntegrand[Sin[c + d*x], (e*x)^m*(a + b*x^n)^p, x
], x] /; FreeQ[{a, b, c, d, e, m, n}, x] && IGtQ[p, 0]
```

### 3.48.4 Maple [A] (verified)

Time = 0.23 (sec) , antiderivative size = 131, normalized size of antiderivative = 0.88

| method | result |
|---|---|
| derivativedivides | $d^4\left(a\left(-\frac{\sin(dx+c)}{4d^4x^4}-\frac{\cos(dx+c)}{12d^3x^3}+\frac{\sin(dx+c)}{24d^2x^2}+\frac{\cos(dx+c)}{24dx}+\frac{\mathrm{Si}(dx)\cos(c)}{24}+\frac{\mathrm{Ci}(dx)\sin(c)}{24}\right)+\frac{b\left(-\frac{\sin(dx}{2d^2x}\right.}{}\right.$ |
| default | $d^4\left(a\left(-\frac{\sin(dx+c)}{4d^4x^4}-\frac{\cos(dx+c)}{12d^3x^3}+\frac{\sin(dx+c)}{24d^2x^2}+\frac{\cos(dx+c)}{24dx}+\frac{\mathrm{Si}(dx)\cos(c)}{24}+\frac{\mathrm{Ci}(dx)\sin(c)}{24}\right)+\frac{b\left(-\frac{\sin(dx}{2d^2x}\right.}{}\right.$ |
| risch | $-\frac{i\,\mathrm{Ei}_1(idx)\cos(c)a\,d^4}{48}+\frac{i\,\mathrm{Ei}_1(-idx)\cos(c)a\,d^4}{48}+\frac{i\,\mathrm{Ei}_1(idx)\cos(c)b\,d^2}{4}-\frac{i\,\mathrm{Ei}_1(-idx)\cos(c)b\,d^2}{4}-\frac{\mathrm{Ei}_1(idx)\sin(c}{48}$ |
| meijerg | $\frac{d^2b\sqrt{\pi}\,\sin(c)\left(-\frac{4}{\sqrt{\pi}\,x^2d^2}-\frac{2\left(2\gamma-3+2\ln(x)+\ln\left(d^2\right)\right)}{\sqrt{\pi}}+\frac{-6d^2x^2+4}{\sqrt{\pi}\,x^2d^2}+\frac{4\gamma}{\sqrt{\pi}}+\frac{4\ln(2)}{\sqrt{\pi}}+\frac{4\ln\left(\frac{dx}{2}\right)}{\sqrt{\pi}}-\frac{4\cos(dx)}{\sqrt{\pi}\,d^2x^2}+\frac{4\sin(dx)}{\sqrt{\pi}\,dx}-\frac{4\,\mathrm{Ci}(dx)}{\sqrt{\pi}}\right.}{8}$ |

input
```
int((b*x^2+a)*sin(d*x+c)/x^5,x,method=_RETURNVERBOSE)
```

output
```
d^4*(a*(-1/4*sin(d*x+c)/d^4/x^4-1/12*cos(d*x+c)/d^3/x^3+1/24*sin(d*x+c)/d^
2/x^2+1/24*cos(d*x+c)/d/x+1/24*Si(d*x)*cos(c)+1/24*Ci(d*x)*sin(c))+1/d^2*b
*(-1/2*sin(d*x+c)/d^2/x^2-1/2*cos(d*x+c)/d/x-1/2*Si(d*x)*cos(c)-1/2*Ci(d*x
)*sin(c)))
```

### 3.48.5 Fricas [A] (verification not implemented)

Time = 0.32 (sec) , antiderivative size = 101, normalized size of antiderivative = 0.68

$$\int \frac{(a+bx^2)\sin(c+dx)}{x^5}\,dx$$
$$= \frac{(ad^4-12\,bd^2)x^4\,\mathrm{Ci}\,(dx)\sin{(c)}+(ad^4-12\,bd^2)x^4\cos{(c)}\,\mathrm{Si}\,(dx)+((ad^3-12\,bd)x^3-2\,adx)\cos{(dx+c)}}{24\,x^4}$$

input
```
integrate((b*x^2+a)*sin(d*x+c)/x^5,x, algorithm="fricas")
```

output
```
1/24*((a*d^4 - 12*b*d^2)*x^4*cos_integral(d*x)*sin(c) + (a*d^4 - 12*b*d^2)
*x^4*cos(c)*sin_integral(d*x) + ((a*d^3 - 12*b*d)*x^3 - 2*a*d*x)*cos(d*x +
 c) + ((a*d^2 - 12*b)*x^2 - 6*a)*sin(d*x + c))/x^4
```

### 3.48.6 Sympy [F]

$$\int \frac{(a+bx^2)\sin(c+dx)}{x^5}\,dx = \int \frac{(a+bx^2)\sin{(c+dx)}}{x^5}\,dx$$

input
```
integrate((b*x**2+a)*sin(d*x+c)/x**5,x)
```

output
```
Integral((a + b*x**2)*sin(c + d*x)/x**5, x)
```

### 3.48.7 Maxima [C] (verification not implemented)

Result contains complex when optimal does not.

Time = 0.80 (sec) , antiderivative size = 121, normalized size of antiderivative = 0.81

$$\int \frac{(a+bx^2)\sin(c+dx)}{x^5}\,dx =$$
$$-\frac{((a(i\,\Gamma(-4,i\,dx)-i\,\Gamma(-4,-i\,dx))\cos{(c)}+a(\Gamma(-4,i\,dx)+\Gamma(-4,-i\,dx))\sin{(c)})d^6-12\,(b(i\,\Gamma(-4,i\,d}{}$$

input
```
integrate((b*x^2+a)*sin(d*x+c)/x^5,x, algorithm="maxima")
```

output
```
-1/2*(((a*(I*gamma(-4, I*d*x) - I*gamma(-4, -I*d*x))*cos(c) + a*(gamma(-4,
 I*d*x) + gamma(-4, -I*d*x))*sin(c))*d^6 - 12*(b*(I*gamma(-4, I*d*x) - I*g
amma(-4, -I*d*x))*cos(c) + b*(gamma(-4, I*d*x) + gamma(-4, -I*d*x))*sin(c)
)*d^4)*x^4 + 2*b*d*x*cos(d*x + c) + 6*b*sin(d*x + c))/(d^2*x^4)
```

### 3.48.8 Giac [C] (verification not implemented)

Result contains higher order function than in optimal. Order 9 vs. order 4.

Time = 0.30 (sec) , antiderivative size = 1086, normalized size of antiderivative = 7.29

$$\int \frac{(a+bx^2)\sin(c+dx)}{x^5}\,dx = \text{Too large to display}$$

input
```
integrate((b*x^2+a)*sin(d*x+c)/x^5,x, algorithm="giac")
```

output
```
-1/48*(a*d^4*x^4*imag_part(cos_integral(d*x))*tan(1/2*d*x)^2*tan(1/2*c)^2
- a*d^4*x^4*imag_part(cos_integral(-d*x))*tan(1/2*d*x)^2*tan(1/2*c)^2 + 2*
a*d^4*x^4*sin_integral(d*x)*tan(1/2*d*x)^2*tan(1/2*c)^2 - 2*a*d^4*x^4*real
_part(cos_integral(d*x))*tan(1/2*d*x)^2*tan(1/2*c) - 2*a*d^4*x^4*real_part
(cos_integral(-d*x))*tan(1/2*d*x)^2*tan(1/2*c) - a*d^4*x^4*imag_part(cos_i
ntegral(d*x))*tan(1/2*d*x)^2 + a*d^4*x^4*imag_part(cos_integral(-d*x))*tan
(1/2*d*x)^2 - 2*a*d^4*x^4*sin_integral(d*x)*tan(1/2*d*x)^2 + a*d^4*x^4*ima
g_part(cos_integral(d*x))*tan(1/2*c)^2 - a*d^4*x^4*imag_part(cos_integral(
-d*x))*tan(1/2*c)^2 + 2*a*d^4*x^4*sin_integral(d*x)*tan(1/2*c)^2 - 12*b*d^
2*x^4*imag_part(cos_integral(d*x))*tan(1/2*d*x)^2*tan(1/2*c)^2 + 12*b*d^2*
x^4*imag_part(cos_integral(-d*x))*tan(1/2*d*x)^2*tan(1/2*c)^2 - 24*b*d^2*x
^4*sin_integral(d*x)*tan(1/2*d*x)^2*tan(1/2*c)^2 - 2*a*d^4*x^4*real_part(c
os_integral(d*x))*tan(1/2*c) - 2*a*d^4*x^4*real_part(cos_integral(-d*x))*t
an(1/2*c) + 24*b*d^2*x^4*real_part(cos_integral(d*x))*tan(1/2*d*x)^2*tan(1
/2*c) + 24*b*d^2*x^4*real_part(cos_integral(-d*x))*tan(1/2*d*x)^2*tan(1/2*
c) - 2*a*d^3*x^3*tan(1/2*d*x)^2*tan(1/2*c)^2 - a*d^4*x^4*imag_part(cos_int
egral(d*x)) + a*d^4*x^4*imag_part(cos_integral(-d*x)) - 2*a*d^4*x^4*sin_in
tegral(d*x) + 12*b*d^2*x^4*imag_part(cos_integral(d*x))*tan(1/2*d*x)^2 - 1
2*b*d^2*x^4*imag_part(cos_integral(-d*x))*tan(1/2*d*x)^2 + 24*b*d^2*x^4*si
n_integral(d*x)*tan(1/2*d*x)^2 - 12*b*d^2*x^4*imag_part(cos_integral(d*...
```

### 3.48.9 Mupad [F(-1)]

Timed out.

$$\int \frac{(a+bx^2)\sin(c+dx)}{x^5}\,dx = \int \frac{\sin(c+d\,x)\ (b\,x^2+a)}{x^5}\,dx$$

input
```
int((sin(c + d*x)*(a + b*x^2))/x^5,x)
```

output
```
int((sin(c + d*x)*(a + b*x^2))/x^5, x)
```

# 3.49 $\int x^2(a+bx^2)^2\sin(c+dx)\,dx$



## 3.49.1 Optimal result

Integrand size = 19, antiderivative size = 236

$$\begin{aligned}\int x^2(a+bx^2)^2\sin(c+dx)\,dx &= \frac{720b^2\cos(c+dx)}{d^7}-\frac{48ab\cos(c+dx)}{d^5}+\frac{2a^2\cos(c+dx)}{d^3}\\ &-\frac{360b^2x^2\cos(c+dx)}{d^5}+\frac{24abx^2\cos(c+dx)}{d^3}\\ &-\frac{a^2x^2\cos(c+dx)}{d}+\frac{30b^2x^4\cos(c+dx)}{d^3}\\ &-\frac{2abx^4\cos(c+dx)}{d}-\frac{b^2x^6\cos(c+dx)}{d}\\ &+\frac{720b^2x\sin(c+dx)}{d^6}-\frac{48abx\sin(c+dx)}{d^4}\\ &+\frac{2a^2x\sin(c+dx)}{d^2}-\frac{120b^2x^3\sin(c+dx)}{d^4}\\ &+\frac{8abx^3\sin(c+dx)}{d^2}+\frac{6b^2x^5\sin(c+dx)}{d^2}\end{aligned}$$

output
```
720*b^2*cos(d*x+c)/d^7-48*a*b*cos(d*x+c)/d^5+2*a^2*cos(d*x+c)/d^3-360*b^2*
x^2*cos(d*x+c)/d^5+24*a*b*x^2*cos(d*x+c)/d^3-a^2*x^2*cos(d*x+c)/d+30*b^2*x
^4*cos(d*x+c)/d^3-2*a*b*x^4*cos(d*x+c)/d-b^2*x^6*cos(d*x+c)/d+720*b^2*x*si
n(d*x+c)/d^6-48*a*b*x*sin(d*x+c)/d^4+2*a^2*x*sin(d*x+c)/d^2-120*b^2*x^3*si
n(d*x+c)/d^4+8*a*b*x^3*sin(d*x+c)/d^2+6*b^2*x^5*sin(d*x+c)/d^2
```

### 3.49.2 Mathematica [A] (verified)

Time = 0.26 (sec) , antiderivative size = 139, normalized size of antiderivative = 0.59

$$\int x^2(a+bx^2)^2\sin(c+dx)\,dx = \frac{-((a^2d^4(-2+d^2x^2)+2abd^2(24-12d^2x^2+d^4x^4)+b^2(-720+360d^2x^2-30d^4x^4+d^6x^6))\cos(c+dx))}{d^7}$$

input
```
Integrate[x^2*(a + b*x^2)^2*Sin[c + d*x],x]
```

output
```
(-((a^2*d^4*(-2 + d^2*x^2) + 2*a*b*d^2*(24 - 12*d^2*x^2 + d^4*x^4) + b^2*(
-720 + 360*d^2*x^2 - 30*d^4*x^4 + d^6*x^6))*Cos[c + d*x]) + 2*d*x*(a^2*d^4
 + 4*a*b*d^2*(-6 + d^2*x^2) + 3*b^2*(120 - 20*d^2*x^2 + d^4*x^4))*Sin[c +
d*x])/d^7
```

### 3.49.3 Rubi [A] (verified)

Time = 0.54 (sec) , antiderivative size = 236, normalized size of antiderivative = 1.00, number of steps used = 2, number of rules used = 2, $\frac{\text{number of rules}}{\text{integrand size}}$ = 0.105, Rules used = {3820, 2009}

Below are the steps used by Rubi to obtain the solution. The rule number used for the transformation is given above next to the arrow. The rules definitions used are listed below.

$$\int x^2(a+bx^2)^2\sin(c+dx)\,dx$$

$$\Big\downarrow \text{3820}$$

$$\int \left(a^2x^2\sin(c+dx)+2abx^4\sin(c+dx)+b^2x^6\sin(c+dx)\right)dx$$

$$\Big\downarrow \text{2009}$$

$$\frac{2a^2\cos(c+dx)}{d^3}+\frac{2a^2x\sin(c+dx)}{d^2}-\frac{a^2x^2\cos(c+dx)}{d}-\frac{48ab\cos(c+dx)}{d^5}-\frac{48abx\sin(c+dx)}{d^4}+\frac{24abx^2\cos(c+dx)}{d^3}+\frac{8abx^3\sin(c+dx)}{d^2}-\frac{2abx^4\cos(c+dx)}{d}+\frac{720b^2\cos(c+dx)}{d^7}+\frac{720b^2x\sin(c+dx)}{d^6}-\frac{360b^2x^2\cos(c+dx)}{d^5}-\frac{120b^2x^3\sin(c+dx)}{d^4}+\frac{30b^2x^4\cos(c+dx)}{d^3}+\frac{6b^2x^5\sin(c+dx)}{d^2}-\frac{b^2x^6\cos(c+dx)}{d}$$

input
```
Int[x^2*(a + b*x^2)^2*Sin[c + d*x],x]
```

output
```
(720*b^2*Cos[c + d*x])/d^7 - (48*a*b*Cos[c + d*x])/d^5 + (2*a^2*Cos[c + d*
x])/d^3 - (360*b^2*x^2*Cos[c + d*x])/d^5 + (24*a*b*x^2*Cos[c + d*x])/d^3 -
 (a^2*x^2*Cos[c + d*x])/d + (30*b^2*x^4*Cos[c + d*x])/d^3 - (2*a*b*x^4*Cos
[c + d*x])/d - (b^2*x^6*Cos[c + d*x])/d + (720*b^2*x*Sin[c + d*x])/d^6 - (
48*a*b*x*Sin[c + d*x])/d^4 + (2*a^2*x*Sin[c + d*x])/d^2 - (120*b^2*x^3*Sin
[c + d*x])/d^4 + (8*a*b*x^3*Sin[c + d*x])/d^2 + (6*b^2*x^5*Sin[c + d*x])/d
^2
```

#### 3.49.3.1 Defintions of rubi rules used

rule 2009
```
Int[u_, x_Symbol] :> Simp[IntSum[u, x], x] /; SumQ[u]
```

rule 3820
```
Int[((e_.)*(x_))^(m_.)*((a_) + (b_.)*(x_)^(n_))^(p_.)*Sin[(c_.) + (d_.)*(x_
)], x_Symbol] :> Int[ExpandIntegrand[Sin[c + d*x], (e*x)^m*(a + b*x^n)^p, x
], x] /; FreeQ[{a, b, c, d, e, m, n}, x] && IGtQ[p, 0]
```

### 3.49.4 Maple [A] (verified)

Time = 0.29 (sec) , antiderivative size = 160, normalized size of antiderivative = 0.68

| method | result |
|---|---|
| risch | $-\frac{(b^2x^6d^6+2ab\,d^6x^4+a^2d^6x^2-30b^2x^4d^4-24ab\,d^4x^2-2a^2d^4+360d^2x^2b^2+48ab\,d^2-720b^2)\cos(dx+c)}{d^7}+\frac{2x(3b^2x^4d^4-\cdots}{}$ |
| parallelrisch | $\frac{\left(x^2(b\,x^2+a)^2d^6+(-30b^2x^4-24ab\,x^2-4a^2)d^4+(360x^2b^2+96ab)d^2-1440b^2\right)\left(\tan^2\left(\frac{dx}{2}+\frac{c}{2}\right)\right)+4((3b\,x^2+a)(b\,x^2+a)d\cdots}{d^7\left(1+\tan^2\left(\frac{dx}{2}+\frac{c}{2}\right)\right)\cdots}$ |
| norman | $\frac{\frac{b^2x^6\left(\tan^2\left(\frac{dx}{2}+\frac{c}{2}\right)\right)}{d}+\frac{(a^2d^4-24ab\,d^2+360b^2)x^2\left(\tan^2\left(\frac{dx}{2}+\frac{c}{2}\right)\right)}{d^5}-\frac{b^2x^6}{d}-\frac{(a^2d^4-24ab\,d^2+360b^2)x^2}{d^5}-\frac{(4a^2d^4-96ab\,d^2+1440b^2\cdots}{d^7}}{\cdots}$ |
| meijerg | $\frac{64b^2\sqrt{\pi}\sin(c)\left(\frac{x(d^2)^{\frac{7}{2}}\left(\frac{21}{8}d^4x^4-\frac{105}{2}d^2x^2+315\right)\cos(dx)}{28\sqrt{\pi}\,d^6}-\frac{(d^2)^{\frac{7}{2}}\left(-\frac{7}{16}d^6x^6+\frac{105}{8}d^4x^4-\frac{315}{2}d^2x^2+315\right)\sin(dx)}{28\sqrt{\pi}\,d^7}\right)}{d^6\sqrt{d^2}}+\frac{64b^2\sqrt{\cdots}}{}$ |
| parts | $-\frac{b^2x^6\cos(dx+c)}{d}-\frac{2ab\,x^4\cos(dx+c)}{d}-\frac{a^2x^2\cos(dx+c)}{d}+\frac{-\frac{2a^2c\sin(dx+c)}{d}+\frac{2a^2(\cos(dx+c)+(dx+c)\sin(dx+c))}{d}-\frac{8ab\cdots}{}}{}$ |
| derivativedivides | $\frac{-a^2c^2\cos(dx+c)-2a^2c(\sin(dx+c)-\cos(dx+c)(dx+c))+a^2\left(-(dx+c)^2\cos(dx+c)+2\cos(dx+c)+2(dx+c)\sin(dx+c)\right)-\cdots}{}$ |
| default | $\frac{-a^2c^2\cos(dx+c)-2a^2c(\sin(dx+c)-\cos(dx+c)(dx+c))+a^2\left(-(dx+c)^2\cos(dx+c)+2\cos(dx+c)+2(dx+c)\sin(dx+c)\right)-\cdots}{}$ |

input
```
int(x^2*(b*x^2+a)^2*sin(d*x+c),x,method=_RETURNVERBOSE)
```

output
```
-(b^2*d^6*x^6+2*a*b*d^6*x^4+a^2*d^6*x^2-30*b^2*d^4*x^4-24*a*b*d^4*x^2-2*a^
2*d^4+360*b^2*d^2*x^2+48*a*b*d^2-720*b^2)/d^7*cos(d*x+c)+2/d^6*x*(3*b^2*d^
4*x^4+4*a*b*d^4*x^2+a^2*d^4-60*b^2*d^2*x^2-24*a*b*d^2+360*b^2)*sin(d*x+c)
```

### 3.49.5 Fricas [A] (verification not implemented)

Time = 0.29 (sec) , antiderivative size = 154, normalized size of antiderivative = 0.65

$$\int x^2(a+bx^2)^2\sin(c+dx)\,dx = -\frac{(b^2d^6x^6-2\,a^2d^4+2\,(abd^6-15\,b^2d^4)x^4+48\,abd^2+(a^2d^6-24\,abd^4+360\,b^2d^2)x^2-720\,b^2)\cos(dx+c\cdots}{d^7}$$

input
```
integrate(x^2*(b*x^2+a)^2*sin(d*x+c),x, algorithm="fricas")
```

output
```
-((b^2*d^6*x^6 - 2*a^2*d^4 + 2*(a*b*d^6 - 15*b^2*d^4)*x^4 + 48*a*b*d^2 + (
a^2*d^6 - 24*a*b*d^4 + 360*b^2*d^2)*x^2 - 720*b^2)*cos(d*x + c) - 2*(3*b^2
*d^5*x^5 + 4*(a*b*d^5 - 15*b^2*d^3)*x^3 + (a^2*d^5 - 24*a*b*d^3 + 360*b^2*
d)*x)*sin(d*x + c))/d^7
```

## 3.49.6 Sympy [A] (verification not implemented)

Time = 0.56 (sec) , antiderivative size = 286, normalized size of antiderivative = 1.21

$$\int x^2(a+bx^2)^2\sin(c+dx)\,dx$$
$$=\begin{cases} -\frac{a^2x^2\cos(c+dx)}{d}+\frac{2a^2x\sin(c+dx)}{d^2}+\frac{2a^2\cos(c+dx)}{d^3}-\frac{2abx^4\cos(c+dx)}{d}+\frac{8abx^3\sin(c+dx)}{d^2}+\frac{24abx^2\cos(c+dx)}{d^3}-\frac{48abx\sin(c-}{d^4} \\ \left(\frac{a^2x^3}{3}+\frac{2abx^5}{5}+\frac{b^2x^7}{7}\right)\sin(c) \end{cases}$$

input
```
integrate(x**2*(b*x**2+a)**2*sin(d*x+c),x)
```

output
```
Piecewise((-a**2*x**2*cos(c + d*x)/d + 2*a**2*x*sin(c + d*x)/d**2 + 2*a**2
*cos(c + d*x)/d**3 - 2*a*b*x**4*cos(c + d*x)/d + 8*a*b*x**3*sin(c + d*x)/d
**2 + 24*a*b*x**2*cos(c + d*x)/d**3 - 48*a*b*x*sin(c + d*x)/d**4 - 48*a*b*
cos(c + d*x)/d**5 - b**2*x**6*cos(c + d*x)/d + 6*b**2*x**5*sin(c + d*x)/d*
*2 + 30*b**2*x**4*cos(c + d*x)/d**3 - 120*b**2*x**3*sin(c + d*x)/d**4 - 36
0*b**2*x**2*cos(c + d*x)/d**5 + 720*b**2*x*sin(c + d*x)/d**6 + 720*b**2*co
s(c + d*x)/d**7, Ne(d, 0)), ((a**2*x**3/3 + 2*a*b*x**5/5 + b**2*x**7/7)*si
n(c), True))
```

## 3.49.7 Maxima [B] (verification not implemented)

Leaf count of result is larger than twice the leaf count of optimal. 612 vs. 2(236) = 472.

Time = 0.22 (sec) , antiderivative size = 612, normalized size of antiderivative = 2.59

$$\int x^2(a+bx^2)^2\sin(c+dx)\,dx =$$

$$-\frac{a^2c^2\cos(dx+c)+\frac{b^2c^6\cos(dx+c)}{d^4}+\frac{2\,abc^4\cos(dx+c)}{d^2}-2\left((dx+c)\cos(dx+c)-\sin(dx+c)\right)a^2c-\frac{6\left((dx+c)\,c\right.}{}}{}$$

input
```
integrate(x^2*(b*x^2+a)^2*sin(d*x+c),x, algorithm="maxima")
```

output
```
-(a^2*c^2*cos(d*x + c) + b^2*c^6*cos(d*x + c)/d^4 + 2*a*b*c^4*cos(d*x + c)
/d^2 - 2*((d*x + c)*cos(d*x + c) - sin(d*x + c))*a^2*c - 6*((d*x + c)*cos(
d*x + c) - sin(d*x + c))*b^2*c^5/d^4 - 8*((d*x + c)*cos(d*x + c) - sin(d*x
 + c))*a*b*c^3/d^2 + (((d*x + c)^2 - 2)*cos(d*x + c) - 2*(d*x + c)*sin(d*x
 + c))*a^2 + 15*(((d*x + c)^2 - 2)*cos(d*x + c) - 2*(d*x + c)*sin(d*x + c)
)*b^2*c^4/d^4 + 12*(((d*x + c)^2 - 2)*cos(d*x + c) - 2*(d*x + c)*sin(d*x +
 c))*a*b*c^2/d^2 - 20*(((d*x + c)^3 - 6*d*x - 6*c)*cos(d*x + c) - 3*((d*x
+ c)^2 - 2)*sin(d*x + c))*b^2*c^3/d^4 - 8*(((d*x + c)^3 - 6*d*x - 6*c)*cos
(d*x + c) - 3*((d*x + c)^2 - 2)*sin(d*x + c))*a*b*c/d^2 + 15*(((d*x + c)^4
 - 12*(d*x + c)^2 + 24)*cos(d*x + c) - 4*((d*x + c)^3 - 6*d*x - 6*c)*sin(d
*x + c))*b^2*c^2/d^4 + 2*(((d*x + c)^4 - 12*(d*x + c)^2 + 24)*cos(d*x + c)
 - 4*((d*x + c)^3 - 6*d*x - 6*c)*sin(d*x + c))*a*b/d^2 - 6*(((d*x + c)^5 -
 20*(d*x + c)^3 + 120*d*x + 120*c)*cos(d*x + c) - 5*((d*x + c)^4 - 12*(d*x
 + c)^2 + 24)*sin(d*x + c))*b^2*c/d^4 + (((d*x + c)^6 - 30*(d*x + c)^4 + 3
60*(d*x + c)^2 - 720)*cos(d*x + c) - 6*((d*x + c)^5 - 20*(d*x + c)^3 + 120
*d*x + 120*c)*sin(d*x + c))*b^2/d^4)/d^3
```

### 3.49.8 Giac [A] (verification not implemented)

Time = 0.29 (sec) , antiderivative size = 162, normalized size of antiderivative = 0.69

$$\int x^2(a+bx^2)^2\sin(c+dx)\,dx = -\frac{(b^2d^6x^6+2\,abd^6x^4+a^2d^6x^2-30\,b^2d^4x^4-24\,abd^4x^2-2\,a^2d^4+360\,b^2d^2x^2+48\,abd^2-720\,b^2)\cos{(dx}}{d^7} + \frac{2\,(3\,b^2d^5x^5+4\,abd^5x^3+a^2d^5x-60\,b^2d^3x^3-24\,abd^3x+360\,b^2dx)\sin{(dx+c)}}{d^7}$$

input
```
integrate(x^2*(b*x^2+a)^2*sin(d*x+c),x, algorithm="giac")
```

output
```
-(b^2*d^6*x^6 + 2*a*b*d^6*x^4 + a^2*d^6*x^2 - 30*b^2*d^4*x^4 - 24*a*b*d^4*
x^2 - 2*a^2*d^4 + 360*b^2*d^2*x^2 + 48*a*b*d^2 - 720*b^2)*cos(d*x + c)/d^7
 + 2*(3*b^2*d^5*x^5 + 4*a*b*d^5*x^3 + a^2*d^5*x - 60*b^2*d^3*x^3 - 24*a*b*
d^3*x + 360*b^2*d*x)*sin(d*x + c)/d^7
```

### 3.49.9 Mupad [B] (verification not implemented)

Time = 0.67 (sec) , antiderivative size = 186, normalized size of antiderivative = 0.79

$$\int x^2 (a+bx^2)^2 \sin(c+dx)\, dx = \frac{2\cos(c+d\,x)\,(a^2\,d^4-24\,a\,b\,d^2+360\,b^2)}{d^7} - \frac{b^2\,x^6\,\cos(c+d\,x)}{d} + \frac{6\,b^2\,x^5\,\sin(c+d\,x)}{d^2} + \frac{2\,x\,\sin(c+d\,x)\,(a^2\,d^4-24\,a\,b\,d^2+360\,b^2)}{d^6} - \frac{x^2\,\cos(c+d\,x)\,(a^2\,d^4-24\,a\,b\,d^2+360\,b^2)}{d^5} + \frac{2\,x^4\,\cos(c+d\,x)\,(15\,b^2-a\,b\,d^2)}{d^3} - \frac{8\,x^3\,\sin(c+d\,x)\,(15\,b^2-a\,b\,d^2)}{d^4}$$

input
```
int(x^2*sin(c + d*x)*(a + b*x^2)^2,x)
```

output
```
(2*cos(c + d*x)*(360*b^2 + a^2*d^4 - 24*a*b*d^2))/d^7 - (b^2*x^6*cos(c + d
*x))/d + (6*b^2*x^5*sin(c + d*x))/d^2 + (2*x*sin(c + d*x)*(360*b^2 + a^2*d
^4 - 24*a*b*d^2))/d^6 - (x^2*cos(c + d*x)*(360*b^2 + a^2*d^4 - 24*a*b*d^2)
)/d^5 + (2*x^4*cos(c + d*x)*(15*b^2 - a*b*d^2))/d^3 - (8*x^3*sin(c + d*x)*
(15*b^2 - a*b*d^2))/d^4
```

# 3.50 $\int x(a+bx^2)^2 \sin(c+dx)\,dx$



## 3.50.1 Optimal result

Integrand size = 17, antiderivative size = 185

$$\int x\left(a+bx^2\right)^2\sin(c+dx)\,dx = -\frac{120b^2x\cos(c+dx)}{d^5}+\frac{12abx\cos(c+dx)}{d^3}-\frac{a^2x\cos(c+dx)}{d} +\frac{20b^2x^3\cos(c+dx)}{d^3}-\frac{2abx^3\cos(c+dx)}{d}-\frac{b^2x^5\cos(c+dx)}{d} +\frac{120b^2\sin(c+dx)}{d^6}-\frac{12ab\sin(c+dx)}{d^4}+\frac{a^2\sin(c+dx)}{d^2} -\frac{60b^2x^2\sin(c+dx)}{d^4}+\frac{6abx^2\sin(c+dx)}{d^2}+\frac{5b^2x^4\sin(c+dx)}{d^2}$$

output
```
-120*b^2*x*cos(d*x+c)/d^5+12*a*b*x*cos(d*x+c)/d^3-a^2*x*cos(d*x+c)/d+20*b^
2*x^3*cos(d*x+c)/d^3-2*a*b*x^3*cos(d*x+c)/d-b^2*x^5*cos(d*x+c)/d+120*b^2*s
in(d*x+c)/d^6-12*a*b*sin(d*x+c)/d^4+a^2*sin(d*x+c)/d^2-60*b^2*x^2*sin(d*x+
c)/d^4+6*a*b*x^2*sin(d*x+c)/d^2+5*b^2*x^4*sin(d*x+c)/d^2
```

## 3.50.2 Mathematica [A] (verified)

Time = 0.16 (sec) , antiderivative size = 113, normalized size of antiderivative = 0.61

$$\int x\left(a+bx^2\right)^2\sin(c+dx)\,dx = \frac{-dx(a^2d^4+2abd^2(-6+d^2x^2)+b^2(120-20d^2x^2+d^4x^4))\cos(c+dx)+(a^2d^4+6abd^2(-2+d^2x^2)+5b}{d^6}$$

input
```
Integrate[x*(a + b*x^2)^2*Sin[c + d*x],x]
```

output
```
(-(d*x*(a^2*d^4 + 2*a*b*d^2*(-6 + d^2*x^2) + b^2*(120 - 20*d^2*x^2 + d^4*x
^4))*Cos[c + d*x]) + (a^2*d^4 + 6*a*b*d^2*(-2 + d^2*x^2) + 5*b^2*(24 - 12*
d^2*x^2 + d^4*x^4))*Sin[c + d*x])/d^6
```

### 3.50.3 Rubi [A] (verified)

Time = 0.43 (sec) , antiderivative size = 185, normalized size of antiderivative = 1.00, number of steps used = 2, number of rules used = 2, $\frac{\text{number of rules}}{\text{integrand size}} = 0.118$, Rules used = {3820, 2009}

Below are the steps used by Rubi to obtain the solution. The rule number used for the transformation is given above next to the arrow. The rules definitions used are listed below.

$$\int x\left(a+bx^2\right)^2\sin(c+dx)\,dx$$

$$\Big\downarrow \text{3820}$$

$$\int \left(a^2x\sin(c+dx)+2abx^3\sin(c+dx)+b^2x^5\sin(c+dx)\right)dx$$

$$\Big\downarrow \text{2009}$$

$$\frac{a^2\sin(c+dx)}{d^2}-\frac{a^2x\cos(c+dx)}{d}-\frac{12ab\sin(c+dx)}{d^4}+\frac{12abx\cos(c+dx)}{d^3}+\frac{6abx^2\sin(c+dx)}{d^2}-\frac{2abx^3\cos(c+dx)}{d}+\frac{120b^2\sin(c+dx)}{d^6}-\frac{120b^2x\cos(c+dx)}{d^5}-\frac{60b^2x^2\sin(c+dx)}{d^4}+\frac{20b^2x^3\cos(c+dx)}{d^3}+\frac{5b^2x^4\sin(c+dx)}{d^2}-\frac{b^2x^5\cos(c+dx)}{d}$$

input
```
Int[x*(a + b*x^2)^2*Sin[c + d*x],x]
```

output
```
(-120*b^2*x*Cos[c + d*x])/d^5 + (12*a*b*x*Cos[c + d*x])/d^3 - (a^2*x*Cos[c
 + d*x])/d + (20*b^2*x^3*Cos[c + d*x])/d^3 - (2*a*b*x^3*Cos[c + d*x])/d -
(b^2*x^5*Cos[c + d*x])/d + (120*b^2*Sin[c + d*x])/d^6 - (12*a*b*Sin[c + d*
x])/d^4 + (a^2*Sin[c + d*x])/d^2 - (60*b^2*x^2*Sin[c + d*x])/d^4 + (6*a*b*
x^2*Sin[c + d*x])/d^2 + (5*b^2*x^4*Sin[c + d*x])/d^2
```

### 3.50.3.1 Defintions of rubi rules used

rule 2009
```
Int[u_, x_Symbol] :> Simp[IntSum[u, x], x] /; SumQ[u]
```

rule 3820
```
Int[((e_.)*(x_))^(m_.)*((a_) + (b_.)*(x_)^(n_))^(p_.)*Sin[(c_.) + (d_.)*(x_
)], x_Symbol] :> Int[ExpandIntegrand[Sin[c + d*x], (e*x)^m*(a + b*x^n)^p, x
], x] /; FreeQ[{a, b, c, d, e, m, n}, x] && IGtQ[p, 0]
```

## 3.50.4 Maple [A] (verified)

Time = 0.27 (sec) , antiderivative size = 127, normalized size of antiderivative = 0.69

| method | result |
|---|---|
| risch | $-\frac{x\left(b^2x^4d^4+2ab\,d^4x^2+a^2d^4-20d^2x^2b^2-12ab\,d^2+120b^2\right)\cos(dx+c)}{d^5}+\frac{\left(5b^2x^4d^4+6ab\,d^4x^2+a^2d^4-60d^2x^2b^2-12ab\,d \ldots\right.}{d^6}$ |
| parallelrisch | $\frac{\left(\left(b\,x^2+a\right)^2d^4+\left(-20x^2b^2-12ab\right)d^2+120b^2\right)xd\left(\tan^2\left(\frac{dx}{2}+\frac{c}{2}\right)\right)+\left(\left(10b^2x^4+12ab\,x^2+2a^2\right)d^4-24b\left(5b\,x^2+a\right)d^2+240b^2\right) \ldots}{d^6\left(1+\tan^2\left(\frac{dx}{2}+\frac{c}{2}\right)\right)}$ |
| norman | $\frac{\frac{b^2x^5\left(\tan^2\left(\frac{dx}{2}+\frac{c}{2}\right)\right)}{d}+\frac{\left(a^2d^4-12ab\,d^2+120b^2\right)x\left(\tan^2\left(\frac{dx}{2}+\frac{c}{2}\right)\right)}{d^5}-\frac{b^2x^5}{d}-\frac{\left(a^2d^4-12ab\,d^2+120b^2\right)x}{d^5}+\frac{2\left(a^2d^4-12ab\,d^2+120b^2\right)\text{ta} \ldots}{d^6}}{1+\tan^2\left(\frac{dx}{2} \ldots\right)}$ |
| meijerg | $\frac{32b^2\sqrt{\pi}\,\sin(c)\left(-\frac{15}{4\sqrt{\pi}}+\frac{\left(\frac{15}{8}d^4x^4-\frac{45}{2}d^2x^2+45\right)\cos(dx)}{12\sqrt{\pi}}+\frac{xd\left(\frac{3}{8}d^4x^4-\frac{15}{2}d^2x^2+45\right)\sin(dx)}{12\sqrt{\pi}}\right)}{d^6}+\frac{32b^2\sqrt{\pi}\,\cos(c)\left(-\frac{xd\left(\frac{7}{8}d^4 \ldots\right)}{\ldots}\right.}{\ldots}$ |
| parts | $-\frac{b^2x^5\cos(dx+c)}{d}-\frac{2ab\,x^3\cos(dx+c)}{d}-\frac{a^2x\cos(dx+c)}{d}+\frac{a^2\sin(dx+c)+\frac{6ab\,c^2\sin(dx+c)}{d^2}-\frac{12abc(\cos(dx+c)+(dx+c) \ldots}{d^2}}{\ldots}$ |
| derivativedivides | $\frac{a^2c\cos(dx+c)+a^2(\sin(dx+c)-\cos(dx+c)(dx+c))+\frac{2ab\,c^3\cos(dx+c)}{d^2}+\frac{6ab\,c^2(\sin(dx+c)-\cos(dx+c)(dx+c))}{d^2}-\frac{6abc\left(-(dx+c)^2 \ldots\right.}{\ldots}}{\ldots}$ |
| default | $\frac{a^2c\cos(dx+c)+a^2(\sin(dx+c)-\cos(dx+c)(dx+c))+\frac{2ab\,c^3\cos(dx+c)}{d^2}+\frac{6ab\,c^2(\sin(dx+c)-\cos(dx+c)(dx+c))}{d^2}-\frac{6abc\left(-(dx+c)^2 \ldots\right.}{\ldots}}{\ldots}$ |

input
```
int(x*(b*x^2+a)^2*sin(d*x+c),x,method=_RETURNVERBOSE)
```

output
```
-1/d^5*x*(b^2*d^4*x^4+2*a*b*d^4*x^2+a^2*d^4-20*b^2*d^2*x^2-12*a*b*d^2+120*
b^2)*cos(d*x+c)+(5*b^2*d^4*x^4+6*a*b*d^4*x^2+a^2*d^4-60*b^2*d^2*x^2-12*a*b
*d^2+120*b^2)/d^6*sin(d*x+c)
```

### 3.50.5 Fricas [A] (verification not implemented)

Time = 0.28 (sec) , antiderivative size = 126, normalized size of antiderivative = 0.68

$$\int x(a+bx^2)^2\sin(c+dx)\,dx = -\frac{(b^2d^5x^5+2\,(abd^5-10\,b^2d^3)x^3+(a^2d^5-12\,abd^3+120\,b^2d)x)\cos{(dx+c)}-(5\,b^2d^4x^4+a^2d^4-12\,abd}{d^6}$$

input
```
integrate(x*(b*x^2+a)^2*sin(d*x+c),x, algorithm="fricas")
```

output
```
-((b^2*d^5*x^5 + 2*(a*b*d^5 - 10*b^2*d^3)*x^3 + (a^2*d^5 - 12*a*b*d^3 + 12
0*b^2*d)*x)*cos(d*x + c) - (5*b^2*d^4*x^4 + a^2*d^4 - 12*a*b*d^2 + 6*(a*b*
d^4 - 10*b^2*d^2)*x^2 + 120*b^2)*sin(d*x + c))/d^6
```

### 3.50.6 Sympy [A] (verification not implemented)

Time = 0.43 (sec) , antiderivative size = 226, normalized size of antiderivative = 1.22

$$\int x(a+bx^2)^2\sin(c+dx)\,dx = \begin{cases} -\frac{a^2x\cos{(c+dx)}}{d}+\frac{a^2\sin{(c+dx)}}{d^2}-\frac{2abx^3\cos{(c+dx)}}{d}+\frac{6abx^2\sin{(c+dx)}}{d^2}+\frac{12abx\cos{(c+dx)}}{d^3}-\frac{12ab\sin{(c+dx)}}{d^4}-\frac{b^2x^5\cos{(c+dx)}}{d} \\ \left(\frac{a^2x^2}{2}+\frac{abx^4}{2}+\frac{b^2x^6}{6}\right)\sin{(c)} \end{cases}$$

input
```
integrate(x*(b*x**2+a)**2*sin(d*x+c),x)
```

output
```
Piecewise((-a**2*x*cos(c + d*x)/d + a**2*sin(c + d*x)/d**2 - 2*a*b*x**3*co
s(c + d*x)/d + 6*a*b*x**2*sin(c + d*x)/d**2 + 12*a*b*x*cos(c + d*x)/d**3 -
 12*a*b*sin(c + d*x)/d**4 - b**2*x**5*cos(c + d*x)/d + 5*b**2*x**4*sin(c +
 d*x)/d**2 + 20*b**2*x**3*cos(c + d*x)/d**3 - 60*b**2*x**2*sin(c + d*x)/d*
*4 - 120*b**2*x*cos(c + d*x)/d**5 + 120*b**2*sin(c + d*x)/d**6, Ne(d, 0)),
 ((a**2*x**2/2 + a*b*x**4/2 + b**2*x**6/6)*sin(c), True))
```

### 3.50.7 Maxima [B] (verification not implemented)

Leaf count of result is larger than twice the leaf count of optimal. 438 vs. $2(185) = 370$.

Time = 0.21 (sec) , antiderivative size = 438, normalized size of antiderivative = 2.37

$$\int x\left(a+bx^2\right)^2\sin(c+dx)\,dx$$
$$= \frac{a^2c\cos(dx+c) + \frac{b^2c^5\cos(dx+c)}{d^4} + \frac{2abc^3\cos(dx+c)}{d^2} - ((dx+c)\cos(dx+c) - \sin(dx+c))a^2 - \frac{5((dx+c)\cos(dx+c}{d^4}}{}$$

input
```
integrate(x*(b*x^2+a)^2*sin(d*x+c),x, algorithm="maxima")
```

output
```
(a^2*c*cos(d*x + c) + b^2*c^5*cos(d*x + c)/d^4 + 2*a*b*c^3*cos(d*x + c)/d^
2 - ((d*x + c)*cos(d*x + c) - sin(d*x + c))*a^2 - 5*((d*x + c)*cos(d*x + c
) - sin(d*x + c))*b^2*c^4/d^4 - 6*((d*x + c)*cos(d*x + c) - sin(d*x + c))*
a*b*c^2/d^2 + 10*(((d*x + c)^2 - 2)*cos(d*x + c) - 2*(d*x + c)*sin(d*x + c
))*b^2*c^3/d^4 + 6*(((d*x + c)^2 - 2)*cos(d*x + c) - 2*(d*x + c)*sin(d*x +
 c))*a*b*c/d^2 - 10*(((d*x + c)^3 - 6*d*x - 6*c)*cos(d*x + c) - 3*((d*x +
c)^2 - 2)*sin(d*x + c))*b^2*c^2/d^4 - 2*(((d*x + c)^3 - 6*d*x - 6*c)*cos(d
*x + c) - 3*((d*x + c)^2 - 2)*sin(d*x + c))*a*b/d^2 + 5*(((d*x + c)^4 - 12
*(d*x + c)^2 + 24)*cos(d*x + c) - 4*((d*x + c)^3 - 6*d*x - 6*c)*sin(d*x +
c))*b^2*c/d^4 - (((d*x + c)^5 - 20*(d*x + c)^3 + 120*d*x + 120*c)*cos(d*x
+ c) - 5*((d*x + c)^4 - 12*(d*x + c)^2 + 24)*sin(d*x + c))*b^2/d^4)/d^2
```

### 3.50.8 Giac [A] (verification not implemented)

Time = 0.28 (sec) , antiderivative size = 129, normalized size of antiderivative = 0.70

$$\int x\left(a+bx^2\right)^2\sin(c+dx)\,dx$$
$$= -\frac{(b^2d^5x^5 + 2\,abd^5x^3 + a^2d^5x - 20\,b^2d^3x^3 - 12\,abd^3x + 120\,b^2dx)\cos(dx+c)}{d^6} + \frac{(5\,b^2d^4x^4 + 6\,abd^4x^2 + a^2d^4 - 60\,b^2d^2x^2 - 12\,abd^2 + 120\,b^2)\sin(dx+c)}{d^6}$$

input
```
integrate(x*(b*x^2+a)^2*sin(d*x+c),x, algorithm="giac")
```

output
```
-(b^2*d^5*x^5 + 2*a*b*d^5*x^3 + a^2*d^5*x - 20*b^2*d^3*x^3 - 12*a*b*d^3*x
+ 120*b^2*d*x)*cos(d*x + c)/d^6 + (5*b^2*d^4*x^4 + 6*a*b*d^4*x^2 + a^2*d^4
 - 60*b^2*d^2*x^2 - 12*a*b*d^2 + 120*b^2)*sin(d*x + c)/d^6
```

### 3.50.9 Mupad [B] (verification not implemented)

Time = 6.33 (sec) , antiderivative size = 151, normalized size of antiderivative = 0.82

$$\int x(a+bx^2)^2\sin(c+dx)\,dx = \frac{\sin(c+d\,x)\,\left(a^2\,d^4-12\,a\,b\,d^2+120\,b^2\right)}{d^6} - \frac{b^2\,x^5\,\cos(c+d\,x)}{d} + \frac{5\,b^2\,x^4\,\sin(c+d\,x)}{d^2} - \frac{x\,\cos(c+d\,x)\,\left(a^2\,d^4-12\,a\,b\,d^2+120\,b^2\right)}{d^5} + \frac{2\,x^3\,\cos(c+d\,x)\,\left(10\,b^2-a\,b\,d^2\right)}{d^3} - \frac{6\,x^2\,\sin(c+d\,x)\,\left(10\,b^2-a\,b\,d^2\right)}{d^4}$$

input
```
int(x*sin(c + d*x)*(a + b*x^2)^2,x)
```

output
```
(sin(c + d*x)*(120*b^2 + a^2*d^4 - 12*a*b*d^2))/d^6 - (b^2*x^5*cos(c + d*x
))/d + (5*b^2*x^4*sin(c + d*x))/d^2 - (x*cos(c + d*x)*(120*b^2 + a^2*d^4 -
 12*a*b*d^2))/d^5 + (2*x^3*cos(c + d*x)*(10*b^2 - a*b*d^2))/d^3 - (6*x^2*s
in(c + d*x)*(10*b^2 - a*b*d^2))/d^4
```

# 3.51 $\int (a+bx^2)^2 \sin(c+dx)\,dx$



## 3.51.1 Optimal result

Integrand size = 16, antiderivative size = 138

$$\begin{aligned}\int (a+bx^2)^2 \sin(c+dx)\,dx = &-\frac{24b^2\cos(c+dx)}{d^5}+\frac{4ab\cos(c+dx)}{d^3}-\frac{a^2\cos(c+dx)}{d}\\ &+\frac{12b^2x^2\cos(c+dx)}{d^3}-\frac{2abx^2\cos(c+dx)}{d}-\frac{b^2x^4\cos(c+dx)}{d}\\ &-\frac{24b^2x\sin(c+dx)}{d^4}+\frac{4abx\sin(c+dx)}{d^2}+\frac{4b^2x^3\sin(c+dx)}{d^2}\end{aligned}$$

output
```
-24*b^2*cos(d*x+c)/d^5+4*a*b*cos(d*x+c)/d^3-a^2*cos(d*x+c)/d+12*b^2*x^2*co
s(d*x+c)/d^3-2*a*b*x^2*cos(d*x+c)/d-b^2*x^4*cos(d*x+c)/d-24*b^2*x*sin(d*x+
c)/d^4+4*a*b*x*sin(d*x+c)/d^2+4*b^2*x^3*sin(d*x+c)/d^2
```

## 3.51.2 Mathematica [A] (verified)

Time = 0.12 (sec) , antiderivative size = 86, normalized size of antiderivative = 0.62

$$\int (a+bx^2)^2 \sin(c+dx)\,dx$$
$$=\frac{-((a^2d^4+2abd^2(-2+d^2x^2)+b^2(24-12d^2x^2+d^4x^4))\cos(c+dx))+4bdx(ad^2+b(-6+d^2x^2))\sin(c+}{d^5}$$

input
```
Integrate[(a + b*x^2)^2*Sin[c + d*x],x]
```

output
```
(-((a^2*d^4 + 2*a*b*d^2*(-2 + d^2*x^2) + b^2*(24 - 12*d^2*x^2 + d^4*x^4))*
Cos[c + d*x]) + 4*b*d*x*(a*d^2 + b*(-6 + d^2*x^2))*Sin[c + d*x])/d^5
```

### 3.51.3 Rubi [A] (verified)

Time = 0.33 (sec) , antiderivative size = 138, normalized size of antiderivative = 1.00, number of steps used = 2, number of rules used = 2, $\frac{\text{number of rules}}{\text{integrand size}}$ = 0.125, Rules used = {3810, 2009}

Below are the steps used by Rubi to obtain the solution. The rule number used for the transformation is given above next to the arrow. The rules definitions used are listed below.

$$\int (a+bx^2)^2 \sin(c+dx)\,dx$$

$$\Big\downarrow \text{3810}$$

$$\int \left(a^2\sin(c+dx)+2abx^2\sin(c+dx)+b^2x^4\sin(c+dx)\right)dx$$

$$\Big\downarrow \text{2009}$$

$$-\frac{a^2\cos(c+dx)}{d}+\frac{4ab\cos(c+dx)}{d^3}+\frac{4abx\sin(c+dx)}{d^2}-\frac{2abx^2\cos(c+dx)}{d}-\frac{24b^2\cos(c+dx)}{d^5}-\frac{24b^2x\sin(c+dx)}{d^4}+\frac{12b^2x^2\cos(c+dx)}{d^3}+\frac{4b^2x^3\sin(c+dx)}{d^2}-\frac{b^2x^4\cos(c+dx)}{d}$$

input
```
Int[(a + b*x^2)^2*Sin[c + d*x],x]
```

output
```
(-24*b^2*Cos[c + d*x])/d^5 + (4*a*b*Cos[c + d*x])/d^3 - (a^2*Cos[c + d*x])
/d + (12*b^2*x^2*Cos[c + d*x])/d^3 - (2*a*b*x^2*Cos[c + d*x])/d - (b^2*x^4
*Cos[c + d*x])/d - (24*b^2*x*Sin[c + d*x])/d^4 + (4*a*b*x*Sin[c + d*x])/d^
2 + (4*b^2*x^3*Sin[c + d*x])/d^2
```

#### 3.51.3.1 Defintions of rubi rules used

rule 2009
```
Int[u_, x_Symbol] :> Simp[IntSum[u, x], x] /; SumQ[u]
```

rule 3810
```
Int[((a_) + (b_.)*(x_)^(n_))^(p_.)*Sin[(c_.) + (d_.)*(x_)], x_Symbol] :> In
t[ExpandIntegrand[Sin[c + d*x], (a + b*x^n)^p, x], x] /; FreeQ[{a, b, c, d,
 n}, x] && IGtQ[p, 0]
```

### 3.51.4 Maple [A] (verified)

Time = 0.25 (sec) , antiderivative size = 94, normalized size of antiderivative = 0.68

| method | result |
|---|---|
| risch | $-\frac{(b^2x^4d^4+2abd^4x^2+a^2d^4-12d^2x^2b^2-4abd^2+24b^2)\cos(dx+c)}{d^5}+\frac{4bx(d^2x^2b+ad^2-6b)\sin(dx+c)}{d^4}$ |
| parallelrisch | $2x^2d^2\Big(\Big(\Big(\frac{bx^2}{2}+a\Big)d^2-6b\Big)b\Big(\tan^2\Big(\frac{dx}{2}+\frac{c}{2}\Big)\Big)+8((bx^2+a)d^2-6b)xdb\tan\Big(\frac{dx}{2}+\frac{c}{2}\Big)+(-b^2x^4-2abx^2-2a^2)d^4+(12x^2b^2+8$ / $d^5\Big(1+\tan^2\Big(\frac{dx}{2}+\frac{c}{2}\Big)\Big)$ |
| norman | $\frac{b^2x^4(\tan^2(\frac{dx}{2}+\frac{c}{2}))}{d}-\frac{2a^2d^4-8abd^2+48b^2}{d^5}-\frac{b^2x^4}{d}+\frac{8b^2x^3\tan(\frac{dx}{2}+\frac{c}{2})}{d^2}-\frac{2b(ad^2-6b)x^2}{d^3}+\frac{8b(ad^2-6b)x\tan(\frac{dx}{2}+\frac{c}{2})}{d^4}+\frac{2b(ad^2$ / $1+\tan^2\Big(\frac{dx}{2}+\frac{c}{2}\Big)$ |
| parts | $-\frac{b^2x^4\cos(dx+c)}{d}-\frac{2abx^2\cos(dx+c)}{d}-\frac{a^2\cos(dx+c)}{d}+\frac{4b\Big(-ac\sin(dx+c)+a(\cos(dx+c)+(dx+c)\sin(dx+c))-b$ |
| meijerg | $\frac{16b^2\sqrt{\pi}\sin(c)\left(-\frac{x(d^2)^{\frac{5}{2}}(-\frac{5d^2x^2}{2}+15)\cos(dx)}{10\sqrt{\pi}d^4}+\frac{(d^2)^{\frac{5}{2}}(\frac{5}{8}d^4x^4-\frac{15}{2}d^2x^2+15)\sin(dx)}{10\sqrt{\pi}d^5}\right)}{d^4\sqrt{d^2}}+\frac{16b^2\sqrt{\pi}\cos(c)\Big(\frac{3}{2\sqrt{\pi}}-\frac{(\frac{3}{8}d^4$ |
| derivativedivides | $-a^2\cos(dx+c)-\frac{2abc^2\cos(dx+c)}{d^2}-\frac{4abc(\sin(dx+c)-\cos(dx+c)(dx+c))}{d^2}+\frac{2ab\Big(-(dx+c)^2\cos(dx+c)+2\cos(dx+c)+2(dx+c)\sin(dx+$ |
| default | $-a^2\cos(dx+c)-\frac{2abc^2\cos(dx+c)}{d^2}-\frac{4abc(\sin(dx+c)-\cos(dx+c)(dx+c))}{d^2}+\frac{2ab\Big(-(dx+c)^2\cos(dx+c)+2\cos(dx+c)+2(dx+c)\sin(dx+$ |

input
```
int((b*x^2+a)^2*sin(d*x+c),x,method=_RETURNVERBOSE)
```

output
```
-(b^2*d^4*x^4+2*a*b*d^4*x^2+a^2*d^4-12*b^2*d^2*x^2-4*a*b*d^2+24*b^2)/d^5*c
os(d*x+c)+4*b*x/d^4*(b*d^2*x^2+a*d^2-6*b)*sin(d*x+c)
```

### 3.51.5 Fricas [A] (verification not implemented)

Time = 0.27 (sec) , antiderivative size = 97, normalized size of antiderivative = 0.70

$$\int (a+bx^2)^2 \sin(c+dx)\,dx =$$
$$-\frac{(b^2d^4x^4 + a^2d^4 - 4\,abd^2 + 2\,(abd^4 - 6\,b^2d^2)x^2 + 24\,b^2)\cos{(dx+c)} - 4\,(b^2d^3x^3 + (abd^3 - 6\,b^2d)x)\sin{(c}}{d^5}$$

input
```
integrate((b*x^2+a)^2*sin(d*x+c),x, algorithm="fricas")
```

output
```
-((b^2*d^4*x^4 + a^2*d^4 - 4*a*b*d^2 + 2*(a*b*d^4 - 6*b^2*d^2)*x^2 + 24*b^
2)*cos(d*x + c) - 4*(b^2*d^3*x^3 + (a*b*d^3 - 6*b^2*d)*x)*sin(d*x + c))/d^
5
```

### 3.51.6 Sympy [A] (verification not implemented)

Time = 0.33 (sec) , antiderivative size = 172, normalized size of antiderivative = 1.25

$$\int (a+bx^2)^2 \sin(c+dx)\,dx$$
$$= \begin{cases} -\frac{a^2\cos{(c+dx)}}{d} - \frac{2abx^2\cos{(c+dx)}}{d} + \frac{4abx\sin{(c+dx)}}{d^2} + \frac{4ab\cos{(c+dx)}}{d^3} - \frac{b^2x^4\cos{(c+dx)}}{d} + \frac{4b^2x^3\sin{(c+dx)}}{d^2} + \frac{12b^2x^2\cos{(c+dx)}}{d^3} \\ \left(a^2x + \frac{2abx^3}{3} + \frac{b^2x^5}{5}\right)\sin{(c)} \end{cases}$$

input
```
integrate((b*x**2+a)**2*sin(d*x+c),x)
```

output
```
Piecewise((-a**2*cos(c + d*x)/d - 2*a*b*x**2*cos(c + d*x)/d + 4*a*b*x*sin(
c + d*x)/d**2 + 4*a*b*cos(c + d*x)/d**3 - b**2*x**4*cos(c + d*x)/d + 4*b**
2*x**3*sin(c + d*x)/d**2 + 12*b**2*x**2*cos(c + d*x)/d**3 - 24*b**2*x*sin(
c + d*x)/d**4 - 24*b**2*cos(c + d*x)/d**5, Ne(d, 0)), ((a**2*x + 2*a*b*x**
3/3 + b**2*x**5/5)*sin(c), True))
```

### 3.51.7 Maxima [B] (verification not implemented)

Leaf count of result is larger than twice the leaf count of optimal. 292 vs. 2(138) = 276.

Time = 0.19 (sec) , antiderivative size = 292, normalized size of antiderivative = 2.12

$$\int \left(a+bx^2\right)^2 \sin(c+dx)\,dx =$$

$$-\frac{a^2\cos(dx+c)+\frac{b^2c^4\cos(dx+c)}{d^4}+\frac{2\,abc^2\cos(dx+c)}{d^2}-\frac{4\,((dx+c)\cos(dx+c)-\sin(dx+c))b^2c^3}{d^4}-\frac{4\,((dx+c)\cos(dx+c)-\sin(dx+c))}{d^2}$$

input
```
integrate((b*x^2+a)^2*sin(d*x+c),x, algorithm="maxima")
```

output
```
-(a^2*cos(d*x + c) + b^2*c^4*cos(d*x + c)/d^4 + 2*a*b*c^2*cos(d*x + c)/d^2
 - 4*((d*x + c)*cos(d*x + c) - sin(d*x + c))*b^2*c^3/d^4 - 4*((d*x + c)*co
s(d*x + c) - sin(d*x + c))*a*b*c/d^2 + 6*(((d*x + c)^2 - 2)*cos(d*x + c) -
 2*(d*x + c)*sin(d*x + c))*b^2*c^2/d^4 + 2*(((d*x + c)^2 - 2)*cos(d*x + c)
 - 2*(d*x + c)*sin(d*x + c))*a*b/d^2 - 4*(((d*x + c)^3 - 6*d*x - 6*c)*cos(
d*x + c) - 3*((d*x + c)^2 - 2)*sin(d*x + c))*b^2*c/d^4 + (((d*x + c)^4 - 1
2*(d*x + c)^2 + 24)*cos(d*x + c) - 4*((d*x + c)^3 - 6*d*x - 6*c)*sin(d*x +
 c))*b^2/d^4)/d
```

### 3.51.8 Giac [A] (verification not implemented)

Time = 0.29 (sec) , antiderivative size = 99, normalized size of antiderivative = 0.72

$$\begin{aligned}\int \left(a+bx^2\right)^2 \sin(c+dx)\,dx &= -\frac{(b^2d^4x^4+2\,abd^4x^2+a^2d^4-12\,b^2d^2x^2-4\,abd^2+24\,b^2)\cos(dx+c)}{d^5} \\ &\quad+\frac{4\,(b^2d^3x^3+abd^3x-6\,b^2dx)\sin(dx+c)}{d^5}\end{aligned}$$

input
```
integrate((b*x^2+a)^2*sin(d*x+c),x, algorithm="giac")
```

output
```
-(b^2*d^4*x^4 + 2*a*b*d^4*x^2 + a^2*d^4 - 12*b^2*d^2*x^2 - 4*a*b*d^2 + 24*
b^2)*cos(d*x + c)/d^5 + 4*(b^2*d^3*x^3 + a*b*d^3*x - 6*b^2*d*x)*sin(d*x +
c)/d^5
```

### 3.51.9 Mupad [B] (verification not implemented)

Time = 6.26 (sec) , antiderivative size = 118, normalized size of antiderivative = 0.86

$$\int (a+bx^2)^2 \sin(c+dx)\,dx = \frac{4\,b^2\,x^3\,\sin(c+d\,x)}{d^2} - \frac{b^2\,x^4\,\cos(c+d\,x)}{d} - \frac{\cos(c+d\,x)\,(a^2\,d^4-4\,a\,b\,d^2+24\,b^2)}{d^5} - \frac{4\,x\,\sin(c+d\,x)\,(6\,b^2-a\,b\,d^2)}{d^4} + \frac{2\,x^2\,\cos(c+d\,x)\,(6\,b^2-a\,b\,d^2)}{d^3}$$

input
```
int(sin(c + d*x)*(a + b*x^2)^2,x)
```

output
```
(4*b^2*x^3*sin(c + d*x))/d^2 - (b^2*x^4*cos(c + d*x))/d - (cos(c + d*x)*(2
4*b^2 + a^2*d^4 - 4*a*b*d^2))/d^5 - (4*x*sin(c + d*x)*(6*b^2 - a*b*d^2))/d
^4 + (2*x^2*cos(c + d*x)*(6*b^2 - a*b*d^2))/d^3
```

# 3.52 $\int \frac{(a+bx^2)^2 \sin(c+dx)}{x} \, dx$



## 3.52.1 Optimal result

Integrand size = 19, antiderivative size = 111

$$\int \frac{(a+bx^2)^2 \sin(c+dx)}{x} \, dx = \frac{6b^2x\cos(c+dx)}{d^3} - \frac{2abx\cos(c+dx)}{d} - \frac{b^2x^3\cos(c+dx)}{d} + a^2 \operatorname{CosIntegral}(dx)\sin(c) - \frac{6b^2\sin(c+dx)}{d^4} + \frac{2ab\sin(c+dx)}{d^2} + \frac{3b^2x^2\sin(c+dx)}{d^2} + a^2\cos(c)\operatorname{Si}(dx)$$

output
```
6*b^2*x*cos(d*x+c)/d^3-2*a*b*x*cos(d*x+c)/d-b^2*x^3*cos(d*x+c)/d+a^2*cos(c
)*Si(d*x)+a^2*Ci(d*x)*sin(c)-6*b^2*sin(d*x+c)/d^4+2*a*b*sin(d*x+c)/d^2+3*b
^2*x^2*sin(d*x+c)/d^2
```

## 3.52.2 Mathematica [A] (verified)

Time = 0.27 (sec) , antiderivative size = 82, normalized size of antiderivative = 0.74

$$\int \frac{(a+bx^2)^2 \sin(c+dx)}{x} \, dx = -\frac{bx(2ad^2+b(-6+d^2x^2))\cos(c+dx)}{d^3} + a^2 \operatorname{CosIntegral}(dx)\sin(c) + \frac{b(2ad^2+3b(-2+d^2x^2))\sin(c+dx)}{d^4} + a^2\cos(c)\operatorname{Si}(dx)$$

input
```
Integrate[((a + b*x^2)^2*Sin[c + d*x])/x,x]
```

output
```
-((b*x*(2*a*d^2 + b*(-6 + d^2*x^2))*Cos[c + d*x])/d^3) + a^2*CosIntegral[d
*x]*Sin[c] + (b*(2*a*d^2 + 3*b*(-2 + d^2*x^2))*Sin[c + d*x])/d^4 + a^2*Cos
[c]*SinIntegral[d*x]
```

### 3.52.3 Rubi [A] (verified)

Time = 0.34 (sec) , antiderivative size = 111, normalized size of antiderivative = 1.00, number of steps used = 2, number of rules used = 2, $\frac{\text{number of rules}}{\text{integrand size}} = 0.105$, Rules used = {3820, 2009}

Below are the steps used by Rubi to obtain the solution. The rule number used for the transformation is given above next to the arrow. The rules definitions used are listed below.

$$\int \frac{(a+bx^2)^2 \sin(c+dx)}{x} \, dx$$

$$\Big\downarrow \text{ 3820}$$

$$\int \left(\frac{a^2 \sin(c+dx)}{x} + 2abx \sin(c+dx) + b^2x^3 \sin(c+dx)\right) dx$$

$$\Big\downarrow \text{ 2009}$$

$$a^2 \sin(c) \text{CosIntegral}(dx) + a^2 \cos(c)\text{Si}(dx) + \frac{2ab \sin(c+dx)}{d^2} - \frac{2abx \cos(c+dx)}{d} - \frac{6b^2 \sin(c+dx)}{d^4} + \frac{6b^2x \cos(c+dx)}{d^3} + \frac{3b^2x^2 \sin(c+dx)}{d^2} - \frac{b^2x^3 \cos(c+dx)}{d}$$

input
```
Int[((a + b*x^2)^2*Sin[c + d*x])/x,x]
```

output
```
(6*b^2*x*Cos[c + d*x])/d^3 - (2*a*b*x*Cos[c + d*x])/d - (b^2*x^3*Cos[c + d
*x])/d + a^2*CosIntegral[d*x]*Sin[c] - (6*b^2*Sin[c + d*x])/d^4 + (2*a*b*S
in[c + d*x])/d^2 + (3*b^2*x^2*Sin[c + d*x])/d^2 + a^2*Cos[c]*SinIntegral[d
*x]
```

### 3.52.3.1 Defintions of rubi rules used

rule 2009
```
Int[u_, x_Symbol] :> Simp[IntSum[u, x], x] /; SumQ[u]
```

rule 3820
```
Int[((e_.)*(x_))^(m_.)*((a_) + (b_.)*(x_)^(n_))^(p_.)*Sin[(c_.) + (d_.)*(x_
)], x_Symbol] :> Int[ExpandIntegrand[Sin[c + d*x], (e*x)^m*(a + b*x^n)^p, x
], x] /; FreeQ[{a, b, c, d, e, m, n}, x] && IGtQ[p, 0]
```

## 3.52.4 Maple [C] (verified)

Result contains complex when optimal does not.

Time = 0.32 (sec) , antiderivative size = 128, normalized size of antiderivative = 1.15

| method | result |
|---|---|
| risch | $-\frac{b^2x^3\cos(dx+c)}{d}+\frac{ia^2\mathrm{e}^{ic}\,\mathrm{Ei}_1(-idx)}{2}-\frac{ia^2\mathrm{e}^{-ic}\,\mathrm{Ei}_1(idx)}{2}+\frac{3b^2x^2\sin(dx+c)}{d^2}-\frac{2abx\cos(dx+c)}{d}+\frac{2ab\sin(dx+$ |
| derivativedivides | $a^2(\mathrm{Si}\,(dx)\cos\,(c)+\mathrm{Ci}\,(dx)\sin\,(c))+\frac{4abc\cos(dx+c)}{d^2}+\frac{2(c+1)ab(\sin(dx+c)-\cos(dx+c)(dx+c))}{d^2}+4b$ |
| default | $a^2(\mathrm{Si}\,(dx)\cos\,(c)+\mathrm{Ci}\,(dx)\sin\,(c))+\frac{4abc\cos(dx+c)}{d^2}+\frac{2(c+1)ab(\sin(dx+c)-\cos(dx+c)(dx+c))}{d^2}+4b$ |
| meijerg | $\frac{8b^2\sqrt{\pi}\,\sin(c)\left(\frac{3}{4\sqrt{\pi}}-\frac{\left(-\frac{3d^2x^2}{2}+3\right)\cos(dx)}{4\sqrt{\pi}}-\frac{dx\left(-\frac{d^2x^2}{2}+3\right)\sin(dx)}{4\sqrt{\pi}}\right)}{d^4}+\frac{8b^2\sqrt{\pi}\,\cos(c)\left(\frac{xd\left(-\frac{5d^2x^2}{2}+15\right)\cos(dx)}{20\sqrt{\pi}}-\frac{(-1}{}\right.}{d^4}$ |

input
```
int((b*x^2+a)^2*sin(d*x+c)/x,x,method=_RETURNVERBOSE)
```

output
```
-b^2*x^3*cos(d*x+c)/d+1/2*I*a^2*exp(I*c)*Ei(1,-I*d*x)-1/2*I*a^2*exp(-I*c)*
Ei(1,I*d*x)+3*b^2*x^2*sin(d*x+c)/d^2-2*a*b*x*cos(d*x+c)/d+2*a*b*sin(d*x+c)
/d^2+6*b^2*x*cos(d*x+c)/d^3-6*b^2*sin(d*x+c)/d^4
```

### 3.52.5 Fricas [A] (verification not implemented)

Time = 0.28 (sec) , antiderivative size = 97, normalized size of antiderivative = 0.87

$$\int \frac{(a+bx^2)^2 \sin(c+dx)}{x} \, dx$$
$$= \frac{a^2d^4 \operatorname{Ci}(dx) \sin(c) + a^2d^4 \cos(c) \operatorname{Si}(dx) - (b^2d^3x^3 + 2(abd^3 - 3b^2d)x) \cos(dx+c) + (3b^2d^2x^2 + 2abd^2}{d^4}$$

input
```
integrate((b*x^2+a)^2*sin(d*x+c)/x,x, algorithm="fricas")
```

output
```
(a^2*d^4*cos_integral(d*x)*sin(c) + a^2*d^4*cos(c)*sin_integral(d*x) - (b^
2*d^3*x^3 + 2*(a*b*d^3 - 3*b^2*d)*x)*cos(d*x + c) + (3*b^2*d^2*x^2 + 2*a*b
*d^2 - 6*b^2)*sin(d*x + c))/d^4
```

### 3.52.6 Sympy [A] (verification not implemented)

Time = 2.49 (sec) , antiderivative size = 160, normalized size of antiderivative = 1.44

$$\int \frac{(a+bx^2)^2 \sin(c+dx)}{x} \, dx$$
$$= a^2 \sin(c) \operatorname{Ci}(dx) + a^2 \cos(c) \operatorname{Si}(dx) + 2abx \left( \begin{cases} x \sin(c) & \text{for } d=0 \\ -\frac{\cos(c+dx)}{d} & \text{otherwise} \end{cases} \right)$$
$$- 2ab \left( \begin{cases} \frac{x^2 \sin(c)}{2} & \text{for } d=0 \\ -\frac{\begin{cases} \frac{\sin(c+dx)}{d} & \text{for } d \neq 0 \\ x \cos(c) & \text{otherwise} \end{cases}}{d} & \text{otherwise} \end{cases} \right) + b^2x^3 \left( \begin{cases} x \sin(c) & \text{for } d=0 \\ -\frac{\cos(c+dx)}{d} & \text{otherwise} \end{cases} \right)$$
$$- 3b^2 \left( \begin{cases} \frac{x^4 \sin(c)}{4} & \text{for } d=0 \\ -\frac{\begin{cases} \frac{x^2 \sin(c+dx)}{d} + \frac{2x \cos(c+dx)}{d^2} - \frac{2\sin(c+dx)}{d^3} & \text{for } d \neq 0 \\ \frac{x^3 \cos(c)}{3} & \text{otherwise} \end{cases}}{d} & \text{otherwise} \end{cases} \right)$$

input
```
integrate((b*x**2+a)**2*sin(d*x+c)/x,x)
```

output
```
a**2*sin(c)*Ci(d*x) + a**2*cos(c)*Si(d*x) + 2*a*b*x*Piecewise((x*sin(c), E
q(d, 0)), (-cos(c + d*x)/d, True)) - 2*a*b*Piecewise((x**2*sin(c)/2, Eq(d,
 0)), (-Piecewise((sin(c + d*x)/d, Ne(d, 0)), (x*cos(c), True))/d, True))
+ b**2*x**3*Piecewise((x*sin(c), Eq(d, 0)), (-cos(c + d*x)/d, True)) - 3*b
**2*Piecewise((x**4*sin(c)/4, Eq(d, 0)), (-Piecewise((x**2*sin(c + d*x)/d
+ 2*x*cos(c + d*x)/d**2 - 2*sin(c + d*x)/d**3, Ne(d, 0)), (x**3*cos(c)/3,
True))/d, True))
```

### 3.52.7 Maxima [C] (verification not implemented)

Result contains complex when optimal does not.

Time = 1.38 (sec) , antiderivative size = 116, normalized size of antiderivative = 1.05

$$\int \frac{(a+bx^2)^2 \sin(c+dx)}{x}\,dx$$
$$= \frac{(a^2(-i\,\mathrm{Ei}(i\,dx)+i\,\mathrm{Ei}(-i\,dx))\cos(c)+a^2(\mathrm{Ei}(i\,dx)+\mathrm{Ei}(-i\,dx))\sin(c))d^4-2\,(b^2d^3x^3+2\,(abd^3-3\,b^2d)x}{2\,d^4}$$

input
```
integrate((b*x^2+a)^2*sin(d*x+c)/x,x, algorithm="maxima")
```

output
```
1/2*((a^2*(-I*Ei(I*d*x) + I*Ei(-I*d*x))*cos(c) + a^2*(Ei(I*d*x) + Ei(-I*d*
x))*sin(c))*d^4 - 2*(b^2*d^3*x^3 + 2*(a*b*d^3 - 3*b^2*d)*x)*cos(d*x + c) +
 2*(3*b^2*d^2*x^2 + 2*a*b*d^2 - 6*b^2)*sin(d*x + c))/d^4
```

### 3.52.8 Giac [C] (verification not implemented)

Result contains higher order function than in optimal. Order 9 vs. order 4.

Time = 0.31 (sec) , antiderivative size = 725, normalized size of antiderivative = 6.53

$$\int \frac{(a+bx^2)^2 \sin(c+dx)}{x}\,dx = \text{Too large to display}$$

input
```
integrate((b*x^2+a)^2*sin(d*x+c)/x,x, algorithm="giac")
```

output
```
1/2*(2*b^2*d^3*x^3*tan(1/2*d*x + 1/2*c)^2*tan(1/2*c)^2 - a^2*d^4*imag_part
(cos_integral(d*x))*tan(1/2*d*x + 1/2*c)^2*tan(1/2*c)^2 + a^2*d^4*imag_par
t(cos_integral(-d*x))*tan(1/2*d*x + 1/2*c)^2*tan(1/2*c)^2 - 2*a^2*d^4*sin_
integral(d*x)*tan(1/2*d*x + 1/2*c)^2*tan(1/2*c)^2 + 2*b^2*d^3*x^3*tan(1/2*
d*x + 1/2*c)^2 + 2*a^2*d^4*real_part(cos_integral(d*x))*tan(1/2*d*x + 1/2*
c)^2*tan(1/2*c) + 2*a^2*d^4*real_part(cos_integral(-d*x))*tan(1/2*d*x + 1/
2*c)^2*tan(1/2*c) - 2*b^2*d^3*x^3*tan(1/2*c)^2 + 4*a*b*d^3*x*tan(1/2*d*x +
 1/2*c)^2*tan(1/2*c)^2 + a^2*d^4*imag_part(cos_integral(d*x))*tan(1/2*d*x
+ 1/2*c)^2 - a^2*d^4*imag_part(cos_integral(-d*x))*tan(1/2*d*x + 1/2*c)^2
+ 2*a^2*d^4*sin_integral(d*x)*tan(1/2*d*x + 1/2*c)^2 - a^2*d^4*imag_part(c
os_integral(d*x))*tan(1/2*c)^2 + a^2*d^4*imag_part(cos_integral(-d*x))*tan
(1/2*c)^2 - 2*a^2*d^4*sin_integral(d*x)*tan(1/2*c)^2 + 12*b^2*d^2*x^2*tan(
1/2*d*x + 1/2*c)*tan(1/2*c)^2 - 2*b^2*d^3*x^3 + 4*a*b*d^3*x*tan(1/2*d*x +
1/2*c)^2 + 2*a^2*d^4*real_part(cos_integral(d*x))*tan(1/2*c) + 2*a^2*d^4*r
eal_part(cos_integral(-d*x))*tan(1/2*c) - 4*a*b*d^3*x*tan(1/2*c)^2 - 12*b^
2*d*x*tan(1/2*d*x + 1/2*c)^2*tan(1/2*c)^2 + a^2*d^4*imag_part(cos_integral
(d*x)) - a^2*d^4*imag_part(cos_integral(-d*x)) + 2*a^2*d^4*sin_integral(d*
x) + 12*b^2*d^2*x^2*tan(1/2*d*x + 1/2*c) + 8*a*b*d^2*tan(1/2*d*x + 1/2*c)*
tan(1/2*c)^2 - 4*a*b*d^3*x - 12*b^2*d*x*tan(1/2*d*x + 1/2*c)^2 + 12*b^2*d*
x*tan(1/2*c)^2 + 8*a*b*d^2*tan(1/2*d*x + 1/2*c) - 24*b^2*tan(1/2*d*x + ...
```

### 3.52.9 Mupad [F(-1)]

Timed out.

$$\int \frac{(a+bx^2)^2 \sin(c+dx)}{x}\,dx = \int \frac{\sin\left(c+d\,x\right)\,{\left(b\,x^2+a\right)}^2}{x}\,dx$$

input
```
int((sin(c + d*x)*(a + b*x^2)^2)/x,x)
```

output
```
int((sin(c + d*x)*(a + b*x^2)^2)/x, x)
```

# 3.53 $\int \frac{(a+bx^2)^2 \sin(c+dx)}{x^2} \, dx$



## 3.53.1 Optimal result

Integrand size = 19, antiderivative size = 97

$$\int \frac{(a+bx^2)^2 \sin(c+dx)}{x^2} \, dx = \frac{2b^2 \cos(c+dx)}{d^3} - \frac{2ab \cos(c+dx)}{d} - \frac{b^2 x^2 \cos(c+dx)}{d} + a^2 d \cos(c) \operatorname{CosIntegral}(dx) - \frac{a^2 \sin(c+dx)}{x} + \frac{2b^2 x \sin(c+dx)}{d^2} - a^2 d \sin(c) \operatorname{Si}(dx)$$

output
```
a^2*d*Ci(d*x)*cos(c)+2*b^2*cos(d*x+c)/d^3-2*a*b*cos(d*x+c)/d-b^2*x^2*cos(d
*x+c)/d-a^2*d*Si(d*x)*sin(c)-a^2*sin(d*x+c)/x+2*b^2*x*sin(d*x+c)/d^2
```

## 3.53.2 Mathematica [A] (verified)

Time = 0.18 (sec) , antiderivative size = 97, normalized size of antiderivative = 1.00

$$\int \frac{(a+bx^2)^2 \sin(c+dx)}{x^2} \, dx = \frac{2b^2 \cos(c+dx)}{d^3} - \frac{2ab \cos(c+dx)}{d} - \frac{b^2 x^2 \cos(c+dx)}{d} + a^2 d \cos(c) \operatorname{CosIntegral}(dx) - \frac{a^2 \sin(c+dx)}{x} + \frac{2b^2 x \sin(c+dx)}{d^2} - a^2 d \sin(c) \operatorname{Si}(dx)$$

input
```
Integrate[((a + b*x^2)^2*Sin[c + d*x])/x^2,x]
```

output
```
(2*b^2*Cos[c + d*x])/d^3 - (2*a*b*Cos[c + d*x])/d - (b^2*x^2*Cos[c + d*x])
/d + a^2*d*Cos[c]*CosIntegral[d*x] - (a^2*Sin[c + d*x])/x + (2*b^2*x*Sin[c
 + d*x])/d^2 - a^2*d*Sin[c]*SinIntegral[d*x]
```

### 3.53.3 Rubi [A] (verified)

Time = 0.32 (sec) , antiderivative size = 97, normalized size of antiderivative = 1.00, number of steps used = 2, number of rules used = 2, $\frac{\text{number of rules}}{\text{integrand size}} = 0.105$, Rules used = {3820, 2009}

Below are the steps used by Rubi to obtain the solution. The rule number used for the transformation is given above next to the arrow. The rules definitions used are listed below.

$$\int \frac{(a+bx^2)^2 \sin(c+dx)}{x^2} \, dx$$

$$\Big\downarrow \; 3820$$

$$\int \left(\frac{a^2 \sin(c+dx)}{x^2} + 2ab \sin(c+dx) + b^2 x^2 \sin(c+dx)\right) dx$$

$$\Big\downarrow \; 2009$$

$$a^2 d \cos(c) \operatorname{CosIntegral}(dx) - a^2 d \sin(c) \operatorname{Si}(dx) - \frac{a^2 \sin(c+dx)}{x} - \frac{2ab \cos(c+dx)}{d} + \frac{2b^2 \cos(c+dx)}{d^3} + \frac{2b^2 x \sin(c+dx)}{d^2} - \frac{b^2 x^2 \cos(c+dx)}{d}$$

input
```
Int[((a + b*x^2)^2*Sin[c + d*x])/x^2,x]
```

output
```
(2*b^2*Cos[c + d*x])/d^3 - (2*a*b*Cos[c + d*x])/d - (b^2*x^2*Cos[c + d*x])
/d + a^2*d*Cos[c]*CosIntegral[d*x] - (a^2*Sin[c + d*x])/x + (2*b^2*x*Sin[c
 + d*x])/d^2 - a^2*d*Sin[c]*SinIntegral[d*x]
```

#### 3.53.3.1 Defintions of rubi rules used

rule 2009
```
Int[u_, x_Symbol] :> Simp[IntSum[u, x], x] /; SumQ[u]
```

rule 3820
```
Int[((e_.)*(x_))^(m_.)*((a_) + (b_.)*(x_)^(n_))^(p_.)*Sin[(c_.) + (d_.)*(x_
)], x_Symbol] :> Int[ExpandIntegrand[Sin[c + d*x], (e*x)^m*(a + b*x^n)^p, x
], x] /; FreeQ[{a, b, c, d, e, m, n}, x] && IGtQ[p, 0]
```

### 3.53.4 Maple [A] (verified)

Time = 0.35 (sec) , antiderivative size = 156, normalized size of antiderivative = 1.61

| method | result |
|---|---|
| derivativedivides | $d\left(a^2\left(-\frac{\sin(dx+c)}{dx}-\operatorname{Si}(dx)\sin(c)+\operatorname{Ci}(dx)\cos(c)\right)-\frac{2ab\cos(dx+c)}{d^2}-\frac{6b^2c^2\cos(dx+c)}{d^4}-\frac{4c\,b^2}{}\right.$ |
| default | $d\left(a^2\left(-\frac{\sin(dx+c)}{dx}-\operatorname{Si}(dx)\sin(c)+\operatorname{Ci}(dx)\cos(c)\right)-\frac{2ab\cos(dx+c)}{d^2}-\frac{6b^2c^2\cos(dx+c)}{d^4}-\frac{4c\,b^2}{}\right.$ |
| risch | $-\frac{-\pi\,\operatorname{csgn}(dx)\sin(c)a^2d^4x+2\operatorname{Si}(dx)\sin(c)a^2d^4x-i\pi\,\operatorname{csgn}(dx)\cos(c)a^2d^4x+2i\operatorname{Si}(dx)\cos(c)a^2d^4x+2\cos(c)\operatorname{Ei}_1(-idx)}{2d^3x}$ |
| meijerg | $\frac{4b^2\sqrt{\pi}\,\sin(c)\left(\frac{x\left(d^2\right)^{\frac{3}{2}}\cos(dx)}{2\sqrt{\pi}\,d^2}-\frac{\left(d^2\right)^{\frac{3}{2}}\left(-\frac{3d^2x^2}{2}+3\right)\sin(dx)}{6\sqrt{\pi}\,d^3}\right)}{d^2\sqrt{d^2}}+\frac{4b^2\sqrt{\pi}\,\cos(c)\left(-\frac{1}{2\sqrt{\pi}}+\frac{\left(-\frac{d^2x^2}{2}+1\right)\cos(dx)}{2\sqrt{\pi}}+\frac{dx\sin(d}{2\sqrt{\pi}}\right.}{d^3}$ |

input
```
int((b*x^2+a)^2*sin(d*x+c)/x^2,x,method=_RETURNVERBOSE)
```

output
```
d*(a^2*(-sin(d*x+c)/d/x-Si(d*x)*sin(c)+Ci(d*x)*cos(c))-2/d^2*a*b*cos(d*x+c
)-6/d^4*b^2*c^2*cos(d*x+c)-4*c*b^2*(2*c+1)/d^4*(sin(d*x+c)-cos(d*x+c)*(d*x
+c))+(3*c^2+2*c+1)/d^4*b^2*(-(d*x+c)^2*cos(d*x+c)+2*cos(d*x+c)+2*(d*x+c)*s
in(d*x+c)))
```

### 3.53.5 Fricas [A] (verification not implemented)

Time = 0.30 (sec) , antiderivative size = 96, normalized size of antiderivative = 0.99

$$\int \frac{(a+bx^2)^2 \sin(c+dx)}{x^2}\,dx = \frac{a^2d^4x\cos(c)\,\mathrm{Ci}\,(dx) - a^2d^4x\sin(c)\,\mathrm{Si}\,(dx) - (b^2d^2x^3 + 2\,(abd^2 - b^2)x)\cos(dx+c) - (a^2d^3 - 2\,b^2dx^2)\sin}{d^3x}$$

input
```
integrate((b*x^2+a)^2*sin(d*x+c)/x^2,x, algorithm="fricas")
```

output
```
(a^2*d^4*x*cos(c)*cos_integral(d*x) - a^2*d^4*x*sin(c)*sin_integral(d*x) -
 (b^2*d^2*x^3 + 2*(a*b*d^2 - b^2)*x)*cos(d*x + c) - (a^2*d^3 - 2*b^2*d*x^2
)*sin(d*x + c))/(d^3*x)
```

### 3.53.6 Sympy [F]

$$\int \frac{(a+bx^2)^2 \sin(c+dx)}{x^2}\,dx = \int \frac{(a+bx^2)^2 \sin(c+dx)}{x^2}\,dx$$

input
```
integrate((b*x**2+a)**2*sin(d*x+c)/x**2,x)
```

output
```
Integral((a + b*x**2)**2*sin(c + d*x)/x**2, x)
```

### 3.53.7 Maxima [C] (verification not implemented)

Result contains complex when optimal does not.

Time = 1.12 (sec) , antiderivative size = 97, normalized size of antiderivative = 1.00

$$\int \frac{(a+bx^2)^2 \sin(c+dx)}{x^2}\,dx = \frac{(a^2(\Gamma(-1,i\,dx) + \Gamma(-1,-i\,dx))\cos(c) + a^2(-i\,\Gamma(-1,i\,dx) + i\,\Gamma(-1,-i\,dx))\sin(c))d^4 + 4\,b^2dx\sin(dx+}{2\,d^3}$$

input
```
integrate((b*x^2+a)^2*sin(d*x+c)/x^2,x, algorithm="maxima")
```

output
```
1/2*((a^2*(gamma(-1, I*d*x) + gamma(-1, -I*d*x))*cos(c) + a^2*(-I*gamma(-1
, I*d*x) + I*gamma(-1, -I*d*x))*sin(c))*d^4 + 4*b^2*d*x*sin(d*x + c) - 2*(
b^2*d^2*x^2 + 2*a*b*d^2 - 2*b^2)*cos(d*x + c))/d^3
```

### 3.53.8 Giac [C] (verification not implemented)

Result contains higher order function than in optimal. Order 9 vs. order 4.

Time = 0.32 (sec) , antiderivative size = 1638, normalized size of antiderivative = 16.89

$$\int \frac{(a+bx^2)^2 \sin(c+dx)}{x^2} \, dx = \text{Too large to display}$$

input
```
integrate((b*x^2+a)^2*sin(d*x+c)/x^2,x, algorithm="giac")
```

output
```
-1/2*(a^2*d^4*x*real_part(cos_integral(d*x))*tan(1/2*d*x + 1/2*c)^2*tan(1/
2*d*x)^2*tan(1/2*c)^2 + a^2*d^4*x*real_part(cos_integral(-d*x))*tan(1/2*d*
x + 1/2*c)^2*tan(1/2*d*x)^2*tan(1/2*c)^2 + 2*a^2*d^4*x*imag_part(cos_integ
ral(d*x))*tan(1/2*d*x + 1/2*c)^2*tan(1/2*d*x)^2*tan(1/2*c) - 2*a^2*d^4*x*i
mag_part(cos_integral(-d*x))*tan(1/2*d*x + 1/2*c)^2*tan(1/2*d*x)^2*tan(1/2
*c) + 4*a^2*d^4*x*sin_integral(d*x)*tan(1/2*d*x + 1/2*c)^2*tan(1/2*d*x)^2*
tan(1/2*c) - 2*b^2*d^2*x^3*tan(1/2*d*x + 1/2*c)^2*tan(1/2*d*x)^2*tan(1/2*c
)^2 - a^2*d^4*x*real_part(cos_integral(d*x))*tan(1/2*d*x + 1/2*c)^2*tan(1/
2*d*x)^2 - a^2*d^4*x*real_part(cos_integral(-d*x))*tan(1/2*d*x + 1/2*c)^2*
tan(1/2*d*x)^2 + a^2*d^4*x*real_part(cos_integral(d*x))*tan(1/2*d*x + 1/2*
c)^2*tan(1/2*c)^2 + a^2*d^4*x*real_part(cos_integral(-d*x))*tan(1/2*d*x +
1/2*c)^2*tan(1/2*c)^2 + a^2*d^4*x*real_part(cos_integral(d*x))*tan(1/2*d*x
)^2*tan(1/2*c)^2 + a^2*d^4*x*real_part(cos_integral(-d*x))*tan(1/2*d*x)^2*
tan(1/2*c)^2 - 2*b^2*d^2*x^3*tan(1/2*d*x + 1/2*c)^2*tan(1/2*d*x)^2 + 2*a^2
*d^4*x*imag_part(cos_integral(d*x))*tan(1/2*d*x + 1/2*c)^2*tan(1/2*c) - 2*
a^2*d^4*x*imag_part(cos_integral(-d*x))*tan(1/2*d*x + 1/2*c)^2*tan(1/2*c)
+ 4*a^2*d^4*x*sin_integral(d*x)*tan(1/2*d*x + 1/2*c)^2*tan(1/2*c) + 2*a^2*
d^4*x*imag_part(cos_integral(d*x))*tan(1/2*d*x)^2*tan(1/2*c) - 2*a^2*d^4*x
*imag_part(cos_integral(-d*x))*tan(1/2*d*x)^2*tan(1/2*c) + 4*a^2*d^4*x*sin
_integral(d*x)*tan(1/2*d*x)^2*tan(1/2*c) - 2*b^2*d^2*x^3*tan(1/2*d*x + ...
```

### 3.53.9 Mupad [F(-1)]

Timed out.

$$\int \frac{(a+bx^2)^2\sin(c+dx)}{x^2}\,dx = \int \frac{\sin(c+d\,x)\,\left(b\,x^2+a\right)^2}{x^2}\,dx$$

input
```
int((sin(c + d*x)*(a + b*x^2)^2)/x^2,x)
```

output
```
int((sin(c + d*x)*(a + b*x^2)^2)/x^2, x)
```

# 3.54 $\int \frac{(a+bx^2)^2 \sin(c+dx)}{x^3} dx$



## 3.54.1 Optimal result

Integrand size = 19, antiderivative size = 114

$$\int \frac{(a+bx^2)^2 \sin(c+dx)}{x^3} dx = -\frac{a^2 d \cos(c+dx)}{2x} - \frac{b^2 x \cos(c+dx)}{d} + 2ab \operatorname{CosIntegral}(dx) \sin(c) - \frac{1}{2} a^2 d^2 \operatorname{CosIntegral}(dx) \sin(c) + \frac{b^2 \sin(c+dx)}{d^2} - \frac{a^2 \sin(c+dx)}{2x^2} + 2ab \cos(c) \operatorname{Si}(dx) - \frac{1}{2} a^2 d^2 \cos(c) \operatorname{Si}(dx)$$

output
```
-1/2*a^2*d*cos(d*x+c)/x-b^2*x*cos(d*x+c)/d+2*a*b*cos(c)*Si(d*x)-1/2*a^2*d^
2*cos(c)*Si(d*x)+2*a*b*Ci(d*x)*sin(c)-1/2*a^2*d^2*Ci(d*x)*sin(c)+b^2*sin(d
*x+c)/d^2-1/2*a^2*sin(d*x+c)/x^2
```

## 3.54.2 Mathematica [A] (verified)

Time = 0.29 (sec) , antiderivative size = 99, normalized size of antiderivative = 0.87

$$\int \frac{(a+bx^2)^2 \sin(c+dx)}{x^3} dx = \frac{1}{2} \left( -\frac{a^2 d \cos(c+dx)}{x} - \frac{2b^2 x \cos(c+dx)}{d} + a(4b - ad^2) \operatorname{CosIntegral}(dx) \sin(c) + \frac{2b^2 \sin(c+dx)}{d^2} - \frac{a^2 \sin(c+dx)}{x^2} + a(4b - ad^2) \cos(c) \operatorname{Si}(dx) \right)$$

input
```
Integrate[((a + b*x^2)^2*Sin[c + d*x])/x^3,x]
```

output
```
(-((a^2*d*Cos[c + d*x])/x) - (2*b^2*x*Cos[c + d*x])/d + a*(4*b - a*d^2)*Co
sIntegral[d*x]*Sin[c] + (2*b^2*Sin[c + d*x])/d^2 - (a^2*Sin[c + d*x])/x^2
+ a*(4*b - a*d^2)*Cos[c]*SinIntegral[d*x])/2
```

### 3.54.3 Rubi [A] (verified)

Time = 0.36 (sec) , antiderivative size = 114, normalized size of antiderivative = 1.00, number of steps used = 2, number of rules used = 2, $\frac{\text{number of rules}}{\text{integrand size}} = 0.105$, Rules used = {3820, 2009}

Below are the steps used by Rubi to obtain the solution. The rule number used for the transformation is given above next to the arrow. The rules definitions used are listed below.

$$\int \frac{(a+bx^2)^2 \sin(c+dx)}{x^3} \, dx$$
$$\Big\downarrow \text{3820}$$
$$\int \left(\frac{a^2 \sin(c+dx)}{x^3} + \frac{2ab\sin(c+dx)}{x} + b^2 x \sin(c+dx)\right) dx$$
$$\Big\downarrow \text{2009}$$
$$-\frac{1}{2}a^2d^2\sin(c)\,\text{CosIntegral}(dx) - \frac{1}{2}a^2d^2\cos(c)\text{Si}(dx) - \frac{a^2\sin(c+dx)}{2x^2} - \frac{a^2d\cos(c+dx)}{2x} + 2ab\sin(c)\,\text{CosIntegral}(dx) + 2ab\cos(c)\text{Si}(dx) + \frac{b^2\sin(c+dx)}{d^2} - \frac{b^2x\cos(c+dx)}{d}$$

input
```
Int[((a + b*x^2)^2*Sin[c + d*x])/x^3,x]
```

output
```
-1/2*(a^2*d*Cos[c + d*x])/x - (b^2*x*Cos[c + d*x])/d + 2*a*b*CosIntegral[d
*x]*Sin[c] - (a^2*d^2*CosIntegral[d*x]*Sin[c])/2 + (b^2*Sin[c + d*x])/d^2
- (a^2*Sin[c + d*x])/(2*x^2) + 2*a*b*Cos[c]*SinIntegral[d*x] - (a^2*d^2*Co
s[c]*SinIntegral[d*x])/2
```

#### 3.54.3.1 Defintions of rubi rules used

rule 2009
```
Int[u_, x_Symbol] :> Simp[IntSum[u, x], x] /; SumQ[u]
```

rule 3820
```
Int[((e_.)*(x_))^(m_.)*((a_) + (b_.)*(x_)^(n_))^(p_.)*Sin[(c_.) + (d_.)*(x_
)], x_Symbol] :> Int[ExpandIntegrand[Sin[c + d*x], (e*x)^m*(a + b*x^n)^p, x
], x] /; FreeQ[{a, b, c, d, e, m, n}, x] && IGtQ[p, 0]
```

### 3.54.4 Maple [A] (verified)

Time = 0.37 (sec) , antiderivative size = 124, normalized size of antiderivative = 1.09

| method | result |
|---|---|
| derivativedivides | $d^2\left(a^2\left(-\frac{\sin(dx+c)}{2d^2x^2}-\frac{\cos(dx+c)}{2dx}-\frac{\mathrm{Si}(dx)\cos(c)}{2}-\frac{\mathrm{Ci}(dx)\sin(c)}{2}\right)+\frac{2ba(\mathrm{Si}(dx)\cos(c)+\mathrm{Ci}(dx)\sin(c))}{d^2}+\frac{4b\cdots}{}\right.$ |
| default | $d^2\left(a^2\left(-\frac{\sin(dx+c)}{2d^2x^2}-\frac{\cos(dx+c)}{2dx}-\frac{\mathrm{Si}(dx)\cos(c)}{2}-\frac{\mathrm{Ci}(dx)\sin(c)}{2}\right)+\frac{2ba(\mathrm{Si}(dx)\cos(c)+\mathrm{Ci}(dx)\sin(c))}{d^2}+\frac{4b\cdots}{}\right.$ |
| risch | $-\frac{-\cos(c)\pi\ \mathrm{csgn}(dx)a^2d^4x^2+i\sin(c)\pi\ \mathrm{csgn}(dx)a^2d^4x^2+2\cos(c)\,\mathrm{Si}(dx)a^2d^4x^2-2i\sin(c)\,\mathrm{Si}(dx)a^2d^4x^2+4\cos(c)\pi\ \mathrm{csgn}\cdots}{}$ |
| meijerg | $\frac{2b^2\sqrt{\pi}\,\sin(c)\left(-\frac{1}{2\sqrt{\pi}}+\frac{\cos(dx)}{2\sqrt{\pi}}+\frac{dx\sin(dx)}{2\sqrt{\pi}}\right)}{d^2}+\frac{2b^2\sqrt{\pi}\,\cos(c)\left(-\frac{dx\cos(dx)}{2\sqrt{\pi}}+\frac{\sin(dx)}{2\sqrt{\pi}}\right)}{d^2}+ab\sqrt{\pi}\,\sin(c)\left(\frac{2\gamma+2\ln(\cdots}{\sqrt{\cdots}}\right.$ |

input
```
int((b*x^2+a)^2*sin(d*x+c)/x^3,x,method=_RETURNVERBOSE)
```

output
```
d^2*(a^2*(-1/2*sin(d*x+c)/d^2/x^2-1/2*cos(d*x+c)/d/x-1/2*Si(d*x)*cos(c)-1/
2*Ci(d*x)*sin(c))+2/d^2*b*a*(Si(d*x)*cos(c)+Ci(d*x)*sin(c))+4/d^4*b^2*c*co
s(d*x+c)+(3*c+1)/d^4*b^2*(sin(d*x+c)-cos(d*x+c)*(d*x+c)))
```

### 3.54.5 Fricas [A] (verification not implemented)

Time = 0.29 (sec) , antiderivative size = 107, normalized size of antiderivative = 0.94

$$\int \frac{(a+bx^2)^2\sin(c+dx)}{x^3}\,dx =$$
$$-\frac{(a^2d^4-4\,abd^2)x^2\,\mathrm{Ci}\,(dx)\sin\,(c)+(a^2d^4-4\,abd^2)x^2\cos\,(c)\,\mathrm{Si}\,(dx)+(a^2d^3x+2\,b^2dx^3)\cos\,(dx+c)+(\cdots}{2\,d^2x^2}$$

input
```
integrate((b*x^2+a)^2*sin(d*x+c)/x^3,x, algorithm="fricas")
```

output
```
-1/2*((a^2*d^4 - 4*a*b*d^2)*x^2*cos_integral(d*x)*sin(c) + (a^2*d^4 - 4*a*
b*d^2)*x^2*cos(c)*sin_integral(d*x) + (a^2*d^3*x + 2*b^2*d*x^3)*cos(d*x +
c) + (a^2*d^2 - 2*b^2*x^2)*sin(d*x + c))/(d^2*x^2)
```

### 3.54.6 Sympy [F]

$$\int \frac{(a+bx^2)^2\sin(c+dx)}{x^3}\,dx = \int \frac{(a+bx^2)^2\sin\left(c+dx\right)}{x^3}\,dx$$

input
```
integrate((b*x**2+a)**2*sin(d*x+c)/x**3,x)
```

output
```
Integral((a + b*x**2)**2*sin(c + d*x)/x**3, x)
```

### 3.54.7 Maxima [C] (verification not implemented)

Result contains complex when optimal does not.

Time = 2.08 (sec) , antiderivative size = 150, normalized size of antiderivative = 1.32

$$\int \frac{(a+bx^2)^2\sin(c+dx)}{x^3}\,dx$$
$$= \frac{((a^2(i\,\Gamma(-2,i\,dx) - i\,\Gamma(-2,-i\,dx))\cos\left(c\right) + a^2(\Gamma(-2,i\,dx) + \Gamma(-2,-i\,dx))\sin\left(c\right))d^4 - 4\,(ab(i\,\Gamma(-2,i\,d}{}$$

input
```
integrate((b*x^2+a)^2*sin(d*x+c)/x^3,x, algorithm="maxima")
```

output
```
1/2*(((a^2*(I*gamma(-2, I*d*x) - I*gamma(-2, -I*d*x))*cos(c) + a^2*(gamma(
-2, I*d*x) + gamma(-2, -I*d*x))*sin(c))*d^4 - 4*(a*b*(I*gamma(-2, I*d*x) -
 I*gamma(-2, -I*d*x))*cos(c) + a*b*(gamma(-2, I*d*x) + gamma(-2, -I*d*x))*
sin(c))*d^2)*x^2 - 2*(b^2*d*x^3 + 2*a*b*d*x)*cos(d*x + c) + 2*(b^2*x^2 - 2
*a*b)*sin(d*x + c))/(d^2*x^2)
```

### 3.54.8 Giac [C] (verification not implemented)

Result contains higher order function than in optimal. Order 9 vs. order 4.

Time = 0.30 (sec) , antiderivative size = 1058, normalized size of antiderivative = 9.28

$$\int \frac{(a+bx^2)^2 \sin(c+dx)}{x^3} dx = \text{Too large to display}$$

input
```
integrate((b*x^2+a)^2*sin(d*x+c)/x^3,x, algorithm="giac")
```

output
```
1/4*(a^2*d^4*x^2*imag_part(cos_integral(d*x))*tan(1/2*d*x)^2*tan(1/2*c)^2
- a^2*d^4*x^2*imag_part(cos_integral(-d*x))*tan(1/2*d*x)^2*tan(1/2*c)^2 +
2*a^2*d^4*x^2*sin_integral(d*x)*tan(1/2*d*x)^2*tan(1/2*c)^2 - 2*a^2*d^4*x^
2*real_part(cos_integral(d*x))*tan(1/2*d*x)^2*tan(1/2*c) - 2*a^2*d^4*x^2*r
eal_part(cos_integral(-d*x))*tan(1/2*d*x)^2*tan(1/2*c) - a^2*d^4*x^2*imag_
part(cos_integral(d*x))*tan(1/2*d*x)^2 + a^2*d^4*x^2*imag_part(cos_integra
l(-d*x))*tan(1/2*d*x)^2 - 2*a^2*d^4*x^2*sin_integral(d*x)*tan(1/2*d*x)^2 +
 a^2*d^4*x^2*imag_part(cos_integral(d*x))*tan(1/2*c)^2 - a^2*d^4*x^2*imag_
part(cos_integral(-d*x))*tan(1/2*c)^2 + 2*a^2*d^4*x^2*sin_integral(d*x)*ta
n(1/2*c)^2 - 4*a*b*d^2*x^2*imag_part(cos_integral(d*x))*tan(1/2*d*x)^2*tan
(1/2*c)^2 + 4*a*b*d^2*x^2*imag_part(cos_integral(-d*x))*tan(1/2*d*x)^2*tan
(1/2*c)^2 - 8*a*b*d^2*x^2*sin_integral(d*x)*tan(1/2*d*x)^2*tan(1/2*c)^2 -
2*a^2*d^4*x^2*real_part(cos_integral(d*x))*tan(1/2*c) - 2*a^2*d^4*x^2*real
_part(cos_integral(-d*x))*tan(1/2*c) + 8*a*b*d^2*x^2*real_part(cos_integra
l(d*x))*tan(1/2*d*x)^2*tan(1/2*c) + 8*a*b*d^2*x^2*real_part(cos_integral(-
d*x))*tan(1/2*d*x)^2*tan(1/2*c) - 2*a^2*d^3*x*tan(1/2*d*x)^2*tan(1/2*c)^2
- 4*b^2*d*x^3*tan(1/2*d*x)^2*tan(1/2*c)^2 - a^2*d^4*x^2*imag_part(cos_inte
gral(d*x)) + a^2*d^4*x^2*imag_part(cos_integral(-d*x)) - 2*a^2*d^4*x^2*sin
_integral(d*x) + 4*a*b*d^2*x^2*imag_part(cos_integral(d*x))*tan(1/2*d*x)^2
 - 4*a*b*d^2*x^2*imag_part(cos_integral(-d*x))*tan(1/2*d*x)^2 + 8*a*b*d...
```

### 3.54.9 Mupad [F(-1)]

Timed out.

$$\int \frac{(a+bx^2)^2 \sin(c+dx)}{x^3} dx = \int \frac{\sin(c+d\,x)\,(b\,x^2+a)^2}{x^3} dx$$

input
```
int((sin(c + d*x)*(a + b*x^2)^2)/x^3,x)
```

output
```
int((sin(c + d*x)*(a + b*x^2)^2)/x^3, x)
```

3.54. $\int \frac{(a+bx^2)^2 \sin(c+dx)}{x^3} \, dx$

# 3.55 $\int \frac{(a+bx^2)^2 \sin(c+dx)}{x^4} dx$



## 3.55.1 Optimal result

Integrand size = 19, antiderivative size = 134

$$\int \frac{(a+bx^2)^2 \sin(c+dx)}{x^4} dx = -\frac{b^2 \cos(c+dx)}{d} - \frac{a^2 d \cos(c+dx)}{6x^2} + 2abd \cos(c) \operatorname{CosIntegral}(dx) - \frac{1}{6}a^2 d^3 \cos(c) \operatorname{CosIntegral}(dx) - \frac{a^2 \sin(c+dx)}{3x^3} - \frac{2ab \sin(c+dx)}{x} + \frac{a^2 d^2 \sin(c+dx)}{6x} - 2abd \sin(c)\operatorname{Si}(dx) + \frac{1}{6}a^2 d^3 \sin(c)\operatorname{Si}(dx)$$

output
```
2*a*b*d*Ci(d*x)*cos(c)-1/6*a^2*d^3*Ci(d*x)*cos(c)-b^2*cos(d*x+c)/d-1/6*a^2
*d*cos(d*x+c)/x^2-2*a*b*d*Si(d*x)*sin(c)+1/6*a^2*d^3*Si(d*x)*sin(c)-1/3*a^
2*sin(d*x+c)/x^3-2*a*b*sin(d*x+c)/x+1/6*a^2*d^2*sin(d*x+c)/x
```

## 3.55.2 Mathematica [A] (verified)

Time = 0.28 (sec) , antiderivative size = 114, normalized size of antiderivative = 0.85

$$\int \frac{(a+bx^2)^2 \sin(c+dx)}{x^4} dx = \frac{1}{6}\left(-\frac{6b^2 \cos(c+dx)}{d} - \frac{a^2 d \cos(c+dx)}{x^2} - ad(-12b+ad^2) \cos(c) \operatorname{CosIntegral}(dx) - \frac{2a^2 \sin(c+dx)}{x^3} - \frac{12ab \sin(c+dx)}{x} + \frac{a^2 d^2 \sin(c+dx)}{x} + ad(-12b+ad^2) \sin(c)\operatorname{Si}(dx)\right)$$

input
```
Integrate[((a + b*x^2)^2*Sin[c + d*x])/x^4,x]
```

output
```
((-6*b^2*Cos[c + d*x])/d - (a^2*d*Cos[c + d*x])/x^2 - a*d*(-12*b + a*d^2)*
Cos[c]*CosIntegral[d*x] - (2*a^2*Sin[c + d*x])/x^3 - (12*a*b*Sin[c + d*x])
/x + (a^2*d^2*Sin[c + d*x])/x + a*d*(-12*b + a*d^2)*Sin[c]*SinIntegral[d*x
])/6
```

### 3.55.3 Rubi [A] (verified)

Time = 0.42 (sec) , antiderivative size = 134, normalized size of antiderivative = 1.00, number of steps used = 2, number of rules used = 2, $\frac{\text{number of rules}}{\text{integrand size}} = 0.105$, Rules used = {3820, 2009}

Below are the steps used by Rubi to obtain the solution. The rule number used for the transformation is given above next to the arrow. The rules definitions used are listed below.

$$\int \frac{(a+bx^2)^2 \sin(c+dx)}{x^4} \, dx$$

$$\Big\downarrow \text{3820}$$

$$\int \left(\frac{a^2 \sin(c+dx)}{x^4}+\frac{2ab \sin(c+dx)}{x^2}+b^2 \sin(c+dx)\right)dx$$

$$\Big\downarrow \text{2009}$$

$$-\frac{1}{6}a^2d^3\cos(c)\,\text{CosIntegral}(dx)+\frac{1}{6}a^2d^3\sin(c)\text{Si}(dx)+\frac{a^2d^2\sin(c+dx)}{6x}-\frac{a^2\sin(c+dx)}{3x^3}-\frac{a^2d\cos(c+dx)}{6x^2}+2abd\cos(c)\,\text{CosIntegral}(dx)-2abd\sin(c)\text{Si}(dx)-\frac{2ab\sin(c+dx)}{x}-\frac{b^2\cos(c+dx)}{d}$$

input
```
Int[((a + b*x^2)^2*Sin[c + d*x])/x^4,x]
```

output
```
-((b^2*Cos[c + d*x])/d) - (a^2*d*Cos[c + d*x])/(6*x^2) + 2*a*b*d*Cos[c]*Co
sIntegral[d*x] - (a^2*d^3*Cos[c]*CosIntegral[d*x])/6 - (a^2*Sin[c + d*x])/
(3*x^3) - (2*a*b*Sin[c + d*x])/x + (a^2*d^2*Sin[c + d*x])/(6*x) - 2*a*b*d*
Sin[c]*SinIntegral[d*x] + (a^2*d^3*Sin[c]*SinIntegral[d*x])/6
```

#### 3.55.3.1 Defintions of rubi rules used

rule 2009
```
Int[u_, x_Symbol] :> Simp[IntSum[u, x], x] /; SumQ[u]
```

rule 3820
```
Int[((e_.)*(x_))^(m_.)*((a_) + (b_.)*(x_)^(n_))^(p_.)*Sin[(c_.) + (d_.)*(x_
)], x_Symbol] :> Int[ExpandIntegrand[Sin[c + d*x], (e*x)^m*(a + b*x^n)^p, x
], x] /; FreeQ[{a, b, c, d, e, m, n}, x] && IGtQ[p, 0]
```

### 3.55.4 Maple [A] (verified)

Time = 0.36 (sec) , antiderivative size = 120, normalized size of antiderivative = 0.90

| method | result |
|---|---|
| derivativedivides | $d^3\left(a^2\left(-\frac{\sin(dx+c)}{3d^3x^3}-\frac{\cos(dx+c)}{6d^2x^2}+\frac{\sin(dx+c)}{6dx}+\frac{\mathrm{Si}(dx)\sin(c)}{6}-\frac{\mathrm{Ci}(dx)\cos(c)}{6}\right)+\frac{2ab\left(-\frac{\sin(dx+c)}{dx}-\mathrm{Si}(dx)\right.}{d^2}\right.$ |
| default | $d^3\left(a^2\left(-\frac{\sin(dx+c)}{3d^3x^3}-\frac{\cos(dx+c)}{6d^2x^2}+\frac{\sin(dx+c)}{6dx}+\frac{\mathrm{Si}(dx)\sin(c)}{6}-\frac{\mathrm{Ci}(dx)\cos(c)}{6}\right)+\frac{2ab\left(-\frac{\sin(dx+c)}{dx}-\mathrm{Si}(dx)\right.}{d^2}\right.$ |
| risch | $\frac{\cos(c)\,\mathrm{Ei}_1(idx)a^2d^3}{12}+\frac{\cos(c)\,\mathrm{Ei}_1(-idx)a^2d^3}{12}-d\cos(c)\,\mathrm{Ei}_1(idx)\,ab-d\cos(c)\,\mathrm{Ei}_1(-idx)\,ab-\frac{i\,\mathrm{si}}{}$ |
| meijerg | $\frac{b^2\sin(c)\sin(dx)}{d}+\frac{b^2\sqrt{\pi}\cos(c)\left(\frac{1}{\sqrt{\pi}}-\frac{\cos(dx)}{\sqrt{\pi}}\right)}{d}+\frac{d^2ab\sqrt{\pi}\sin(c)\left(-\frac{4d^2\cos\left(x\sqrt{d^2}\right)}{x\left(d^2\right)^{\frac{3}{2}}\sqrt{\pi}}-\frac{4\,\mathrm{Si}\left(x\sqrt{d^2}\right)}{\sqrt{\pi}}\right)}{2\sqrt{d^2}}+\frac{dab\sqrt{\pi}\cos(c}{}$ |

input
```
int((b*x^2+a)^2*sin(d*x+c)/x^4,x,method=_RETURNVERBOSE)
```

output
```
d^3*(a^2*(-1/3*sin(d*x+c)/d^3/x^3-1/6*cos(d*x+c)/d^2/x^2+1/6*sin(d*x+c)/d/
x+1/6*Si(d*x)*sin(c)-1/6*Ci(d*x)*cos(c))+2/d^2*a*b*(-sin(d*x+c)/d/x-Si(d*x
)*sin(c)+Ci(d*x)*cos(c))-1/d^4*b^2*cos(d*x+c))
```

### 3.55.5 Fricas [A] (verification not implemented)

Time = 0.29 (sec) , antiderivative size = 116, normalized size of antiderivative = 0.87

$$\int \frac{(a+bx^2)^2\sin(c+dx)}{x^4}\,dx = -\frac{(a^2d^4-12\,abd^2)x^3\cos(c)\,\mathrm{Ci}(dx)-(a^2d^4-12\,abd^2)x^3\sin(c)\,\mathrm{Si}(dx)+(a^2d^2x+6\,b^2x^3)\cos(dx+c)+}{6\,dx^3}$$

input
```
integrate((b*x^2+a)^2*sin(d*x+c)/x^4,x, algorithm="fricas")
```

output
```
-1/6*((a^2*d^4 - 12*a*b*d^2)*x^3*cos(c)*cos_integral(d*x) - (a^2*d^4 - 12*
a*b*d^2)*x^3*sin(c)*sin_integral(d*x) + (a^2*d^2*x + 6*b^2*x^3)*cos(d*x +
c) + (2*a^2*d - (a^2*d^3 - 12*a*b*d)*x^2)*sin(d*x + c))/(d*x^3)
```

### 3.55.6 Sympy [F]

$$\int \frac{(a+bx^2)^2 \sin(c+dx)}{x^4}\,dx = \int \frac{(a+bx^2)^2 \sin(c+dx)}{x^4}\,dx$$

input
```
integrate((b*x**2+a)**2*sin(d*x+c)/x**4,x)
```

output
```
Integral((a + b*x**2)**2*sin(c + d*x)/x**4, x)
```

### 3.55.7 Maxima [C] (verification not implemented)

Result contains complex when optimal does not.

Time = 1.49 (sec) , antiderivative size = 140, normalized size of antiderivative = 1.04

$$\int \frac{(a+bx^2)^2 \sin(c+dx)}{x^4}\,dx = -\frac{((a^2(\Gamma(-3,i\,dx)+\Gamma(-3,-i\,dx))\cos(c)+a^2(-i\,\Gamma(-3,i\,dx)+i\,\Gamma(-3,-i\,dx))\sin(c))d^5-12\,(ab(\Gamma(-3$$

input
```
integrate((b*x^2+a)^2*sin(d*x+c)/x^4,x, algorithm="maxima")
```

output
```
-1/2*(((a^2*(gamma(-3, I*d*x) + gamma(-3, -I*d*x))*cos(c) + a^2*(-I*gamma(
-3, I*d*x) + I*gamma(-3, -I*d*x))*sin(c))*d^5 - 12*(a*b*(gamma(-3, I*d*x)
+ gamma(-3, -I*d*x))*cos(c) + a*b*(-I*gamma(-3, I*d*x) + I*gamma(-3, -I*d*
x))*sin(c))*d^3)*x^3 + 8*a*b*sin(d*x + c) + 2*(b^2*d*x^3 + 2*a*b*d*x)*cos(
d*x + c))/(d^2*x^3)
```

### 3.55.8 Giac [C] (verification not implemented)

Result contains higher order function than in optimal. Order 9 vs. order 4.

Time = 0.30 (sec) , antiderivative size = 1032, normalized size of antiderivative = 7.70

$$\int \frac{(a+bx^2)^2 \sin(c+dx)}{x^4}\,dx = \text{Too large to display}$$

input
```
integrate((b*x^2+a)^2*sin(d*x+c)/x^4,x, algorithm="giac")
```

output
```
1/12*(a^2*d^4*x^3*real_part(cos_integral(d*x))*tan(1/2*d*x)^2*tan(1/2*c)^2
 + a^2*d^4*x^3*real_part(cos_integral(-d*x))*tan(1/2*d*x)^2*tan(1/2*c)^2 +
 2*a^2*d^4*x^3*imag_part(cos_integral(d*x))*tan(1/2*d*x)^2*tan(1/2*c) - 2*
a^2*d^4*x^3*imag_part(cos_integral(-d*x))*tan(1/2*d*x)^2*tan(1/2*c) + 4*a^
2*d^4*x^3*sin_integral(d*x)*tan(1/2*d*x)^2*tan(1/2*c) - a^2*d^4*x^3*real_p
art(cos_integral(d*x))*tan(1/2*d*x)^2 - a^2*d^4*x^3*real_part(cos_integral
(-d*x))*tan(1/2*d*x)^2 + a^2*d^4*x^3*real_part(cos_integral(d*x))*tan(1/2*
c)^2 + a^2*d^4*x^3*real_part(cos_integral(-d*x))*tan(1/2*c)^2 - 12*a*b*d^2
*x^3*real_part(cos_integral(d*x))*tan(1/2*d*x)^2*tan(1/2*c)^2 - 12*a*b*d^2
*x^3*real_part(cos_integral(-d*x))*tan(1/2*d*x)^2*tan(1/2*c)^2 + 2*a^2*d^4
*x^3*imag_part(cos_integral(d*x))*tan(1/2*c) - 2*a^2*d^4*x^3*imag_part(cos
_integral(-d*x))*tan(1/2*c) + 4*a^2*d^4*x^3*sin_integral(d*x)*tan(1/2*c) -
 24*a*b*d^2*x^3*imag_part(cos_integral(d*x))*tan(1/2*d*x)^2*tan(1/2*c) + 2
4*a*b*d^2*x^3*imag_part(cos_integral(-d*x))*tan(1/2*d*x)^2*tan(1/2*c) - 48
*a*b*d^2*x^3*sin_integral(d*x)*tan(1/2*d*x)^2*tan(1/2*c) - a^2*d^4*x^3*rea
l_part(cos_integral(d*x)) - a^2*d^4*x^3*real_part(cos_integral(-d*x)) + 12
*a*b*d^2*x^3*real_part(cos_integral(d*x))*tan(1/2*d*x)^2 + 12*a*b*d^2*x^3*
real_part(cos_integral(-d*x))*tan(1/2*d*x)^2 - 4*a^2*d^3*x^2*tan(1/2*d*x)^
2*tan(1/2*c) - 12*a*b*d^2*x^3*real_part(cos_integral(d*x))*tan(1/2*c)^2 -
12*a*b*d^2*x^3*real_part(cos_integral(-d*x))*tan(1/2*c)^2 - 4*a^2*d^3*x...
```

### 3.55.9 Mupad [F(-1)]

Timed out.

$$\int \frac{(a+bx^2)^2 \sin(c+dx)}{x^4}\,dx = \int \frac{\sin\left(c+d\,x\right)\,\left(b\,x^2+a\right)^2}{x^4}\,dx$$

input
```
int((sin(c + d*x)*(a + b*x^2)^2)/x^4,x)
```

output
```
int((sin(c + d*x)*(a + b*x^2)^2)/x^4, x)
```

---

3.55. $\int \frac{(a+bx^2)^2 \sin(c+dx)}{x^4}\,dx$

# 3.56 $\int \frac{(a+bx^2)^2 \sin(c+dx)}{x^5} \, dx$



## 3.56.1 Optimal result

Integrand size = 19, antiderivative size = 177

$$\begin{aligned}\int \frac{(a+bx^2)^2 \sin(c+dx)}{x^5} \, dx = &-\frac{a^2 d \cos(c+dx)}{12x^3} - \frac{abd \cos(c+dx)}{x} + \frac{a^2 d^3 \cos(c+dx)}{24x} \\ &+ b^2 \operatorname{CosIntegral}(dx) \sin(c) - abd^2 \operatorname{CosIntegral}(dx) \sin(c) \\ &+ \frac{1}{24} a^2 d^4 \operatorname{CosIntegral}(dx) \sin(c) - \frac{a^2 \sin(c+dx)}{4x^4} \\ &- \frac{ab \sin(c+dx)}{x^2} + \frac{a^2 d^2 \sin(c+dx)}{24x^2} + b^2 \cos(c) \operatorname{Si}(dx) \\ &- abd^2 \cos(c) \operatorname{Si}(dx) + \frac{1}{24} a^2 d^4 \cos(c) \operatorname{Si}(dx)\end{aligned}$$

output
```
-1/12*a^2*d*cos(d*x+c)/x^3-a*b*d*cos(d*x+c)/x+1/24*a^2*d^3*cos(d*x+c)/x+b^
2*cos(c)*Si(d*x)-a*b*d^2*cos(c)*Si(d*x)+1/24*a^2*d^4*cos(c)*Si(d*x)+b^2*Ci
(d*x)*sin(c)-a*b*d^2*Ci(d*x)*sin(c)+1/24*a^2*d^4*Ci(d*x)*sin(c)-1/4*a^2*si
n(d*x+c)/x^4-a*b*sin(d*x+c)/x^2+1/24*a^2*d^2*sin(d*x+c)/x^2
```

### 3.56.2 Mathematica [A] (verified)

Time = 0.34 (sec) , antiderivative size = 122, normalized size of antiderivative = 0.69

$$\int \frac{(a+bx^2)^2\sin(c+dx)}{x^5}\,dx = \frac{adx(-24bx^2+a(-2+d^2x^2))\cos(c+dx)+(24b^2-24abd^2+a^2d^4)\,x^4\,\text{CosIntegral}(dx)\sin(c)+a(-24bx}{24x^4}$$

input
```
Integrate[((a + b*x^2)^2*Sin[c + d*x])/x^5,x]
```

output
```
(a*d*x*(-24*b*x^2 + a*(-2 + d^2*x^2))*Cos[c + d*x] + (24*b^2 - 24*a*b*d^2
+ a^2*d^4)*x^4*CosIntegral[d*x]*Sin[c] + a*(-24*b*x^2 + a*(-6 + d^2*x^2))*
Sin[c + d*x] + (24*b^2 - 24*a*b*d^2 + a^2*d^4)*x^4*Cos[c]*SinIntegral[d*x]
)/(24*x^4)
```

### 3.56.3 Rubi [A] (verified)

Time = 0.52 (sec) , antiderivative size = 177, normalized size of antiderivative = 1.00, number of steps used = 2, number of rules used = 2, $\frac{\text{number of rules}}{\text{integrand size}}$ = 0.105, Rules used = {3820, 2009}

Below are the steps used by Rubi to obtain the solution. The rule number used for the transformation is given above next to the arrow. The rules definitions used are listed below.

$$\int \frac{(a+bx^2)^2\sin(c+dx)}{x^5}\,dx$$

$$\Big\downarrow \text{3820}$$

$$\int \left(\frac{a^2\sin(c+dx)}{x^5}+\frac{2ab\sin(c+dx)}{x^3}+\frac{b^2\sin(c+dx)}{x}\right)dx$$

$$\Big\downarrow \text{2009}$$

$$\frac{1}{24}a^2d^4\sin(c)\,\text{CosIntegral}(dx)+\frac{1}{24}a^2d^4\cos(c)\text{Si}(dx)+\frac{a^2d^3\cos(c+dx)}{24x}+\frac{a^2d^2\sin(c+dx)}{24x^2}-\frac{a^2\sin(c+dx)}{4x^4}-\frac{a^2d\cos(c+dx)}{12x^3}-abd^2\sin(c)\,\text{CosIntegral}(dx)-abd^2\cos(c)\text{Si}(dx)-\frac{ab\sin(c+dx)}{x^2}-\frac{abd\cos(c+dx)}{x}+b^2\sin(c)\,\text{CosIntegral}(dx)+b^2\cos(c)\text{Si}(dx)$$

input
```
Int[((a + b*x^2)^2*Sin[c + d*x])/x^5,x]
```

output
```
-1/12*(a^2*d*Cos[c + d*x])/x^3 - (a*b*d*Cos[c + d*x])/x + (a^2*d^3*Cos[c +
 d*x])/(24*x) + b^2*CosIntegral[d*x]*Sin[c] - a*b*d^2*CosIntegral[d*x]*Sin
[c] + (a^2*d^4*CosIntegral[d*x]*Sin[c])/24 - (a^2*Sin[c + d*x])/(4*x^4) -
(a*b*Sin[c + d*x])/x^2 + (a^2*d^2*Sin[c + d*x])/(24*x^2) + b^2*Cos[c]*SinI
ntegral[d*x] - a*b*d^2*Cos[c]*SinIntegral[d*x] + (a^2*d^4*Cos[c]*SinIntegr
al[d*x])/24
```

### 3.56.3.1 Defintions of rubi rules used

rule 2009
```
Int[u_, x_Symbol] :> Simp[IntSum[u, x], x] /; SumQ[u]
```

rule 3820
```
Int[((e_.)*(x_))^(m_.)*((a_) + (b_.)*(x_)^(n_))^(p_.)*Sin[(c_.) + (d_.)*(x_
)], x_Symbol] :> Int[ExpandIntegrand[Sin[c + d*x], (e*x)^m*(a + b*x^n)^p, x
], x] /; FreeQ[{a, b, c, d, e, m, n}, x] && IGtQ[p, 0]
```

## 3.56.4 Maple [A] (verified)

Time = 0.42 (sec) , antiderivative size = 157, normalized size of antiderivative = 0.89

| method | result |
|---|---|
| derivativedivides | $d^4\left(a^2\left(-\frac{\sin(dx+c)}{4d^4x^4}-\frac{\cos(dx+c)}{12d^3x^3}+\frac{\sin(dx+c)}{24d^2x^2}+\frac{\cos(dx+c)}{24dx}+\frac{\mathrm{Si}(dx)\cos(c)}{24}+\frac{\mathrm{Ci}(dx)\sin(c)}{24}\right)+\frac{2ab\left(-\frac{\sin}{2}\right.}{}\right.$ |
| default | $d^4\left(a^2\left(-\frac{\sin(dx+c)}{4d^4x^4}-\frac{\cos(dx+c)}{12d^3x^3}+\frac{\sin(dx+c)}{24d^2x^2}+\frac{\cos(dx+c)}{24dx}+\frac{\mathrm{Si}(dx)\cos(c)}{24}+\frac{\mathrm{Ci}(dx)\sin(c)}{24}\right)+\frac{2ab\left(-\frac{\sin}{2}\right.}{}\right.$ |
| risch | $\frac{i\,\mathrm{Ei}_1(-idx)\cos(c)a^2d^4}{48}-\frac{i\cos(c)\,\mathrm{Ei}_1(idx)a^2d^4}{48}-\frac{i\cos(c)\,\mathrm{Ei}_1(-idx)ab\,d^2}{2}+\frac{i\cos(c)\,\mathrm{Ei}_1(idx)ab\,d^2}{2}+\frac{i\,\mathrm{Ei}_1(-idx)}{2}$ |
| meijerg | $\frac{b^2\sqrt{\pi}\sin(c)\left(\frac{2\gamma+2\ln(x)+\ln\left(d^2\right)}{\sqrt{\pi}}-\frac{2\gamma}{\sqrt{\pi}}-\frac{2\ln(2)}{\sqrt{\pi}}-\frac{2\ln\left(\frac{dx}{2}\right)}{\sqrt{\pi}}+\frac{2\,\mathrm{Ci}(dx)}{\sqrt{\pi}}\right)}{2}+b^2\cos(c)\,\mathrm{Si}(dx)+\frac{d^2ab\sqrt{\pi}\sin(c)\left(-\right.}{}$ |

input
```
int((b*x^2+a)^2*sin(d*x+c)/x^5,x,method=_RETURNVERBOSE)
```

output
```
d^4*(a^2*(-1/4*sin(d*x+c)/d^4/x^4-1/12*cos(d*x+c)/d^3/x^3+1/24*sin(d*x+c)/
d^2/x^2+1/24*cos(d*x+c)/d/x+1/24*Si(d*x)*cos(c)+1/24*Ci(d*x)*sin(c))+2/d^2
*a*b*(-1/2*sin(d*x+c)/d^2/x^2-1/2*cos(d*x+c)/d/x-1/2*Si(d*x)*cos(c)-1/2*Ci
(d*x)*sin(c))+1/d^4*b^2*(Si(d*x)*cos(c)+Ci(d*x)*sin(c)))
```

### 3.56.5 Fricas [A] (verification not implemented)

Time = 0.29 (sec) , antiderivative size = 129, normalized size of antiderivative = 0.73

$$\int \frac{(a+bx^2)^2 \sin(c+dx)}{x^5}\,dx$$
$$= \frac{(a^2d^4 - 24\,abd^2 + 24\,b^2)x^4\,\mathrm{Ci}\,(dx)\sin(c) + (a^2d^4 - 24\,abd^2 + 24\,b^2)x^4\cos(c)\,\mathrm{Si}\,(dx) - (2\,a^2dx - (a^2d^3 -}{24\,x^4}$$

input
```
integrate((b*x^2+a)^2*sin(d*x+c)/x^5,x, algorithm="fricas")
```

output
```
1/24*((a^2*d^4 - 24*a*b*d^2 + 24*b^2)*x^4*cos_integral(d*x)*sin(c) + (a^2*
d^4 - 24*a*b*d^2 + 24*b^2)*x^4*cos(c)*sin_integral(d*x) - (2*a^2*d*x - (a^
2*d^3 - 24*a*b*d)*x^3)*cos(d*x + c) + ((a^2*d^2 - 24*a*b)*x^2 - 6*a^2)*sin
(d*x + c))/x^4
```

### 3.56.6 Sympy [F]

$$\int \frac{(a+bx^2)^2 \sin(c+dx)}{x^5}\,dx = \int \frac{(a+bx^2)^2 \sin(c+dx)}{x^5}\,dx$$

input
```
integrate((b*x**2+a)**2*sin(d*x+c)/x**5,x)
```

output
```
Integral((a + b*x**2)**2*sin(c + d*x)/x**5, x)
```

### 3.56.7 Maxima [C] (verification not implemented)

Result contains complex when optimal does not.

Time = 8.17 (sec) , antiderivative size = 222, normalized size of antiderivative = 1.25

$$\int \frac{(a+bx^2)^2 \sin(c+dx)}{x^5}\,dx =$$
$$-\frac{((a^2(i\,\Gamma(-4,i\,dx) - i\,\Gamma(-4,-i\,dx))\cos(c) + a^2(\Gamma(-4,i\,dx) + \Gamma(-4,-i\,dx))\sin(c))d^8 - 24\,(ab(i\,\Gamma(-4}{}$$

input
```
integrate((b*x^2+a)^2*sin(d*x+c)/x^5,x, algorithm="maxima")
```

output
```
-1/2*(((a^2*(I*gamma(-4, I*d*x) - I*gamma(-4, -I*d*x))*cos(c) + a^2*(gamma
(-4, I*d*x) + gamma(-4, -I*d*x))*sin(c))*d^8 - 24*(a*b*(I*gamma(-4, I*d*x)
 - I*gamma(-4, -I*d*x))*cos(c) + a*b*(gamma(-4, I*d*x) + gamma(-4, -I*d*x)
)*sin(c))*d^6 - 24*(b^2*(-I*gamma(-4, I*d*x) + I*gamma(-4, -I*d*x))*cos(c)
 - b^2*(gamma(-4, I*d*x) + gamma(-4, -I*d*x))*sin(c))*d^4)*x^4 + 2*(b^2*d^
3*x^3 + 2*(a*b*d^3 - b^2*d)*x)*cos(d*x + c) + 2*(b^2*d^2*x^2 + 6*a*b*d^2 -
 6*b^2)*sin(d*x + c))/(d^4*x^4)
```

### 3.56.8 Giac [C] (verification not implemented)

Result contains higher order function than in optimal. Order 9 vs. order 4.

Time = 0.30 (sec) , antiderivative size = 1497, normalized size of antiderivative = 8.46

$$\int \frac{(a+bx^2)^2 \sin(c+dx)}{x^5} \, dx = \text{Too large to display}$$

input
```
integrate((b*x^2+a)^2*sin(d*x+c)/x^5,x, algorithm="giac")
```

output
```
-1/48*(a^2*d^4*x^4*imag_part(cos_integral(d*x))*tan(1/2*d*x)^2*tan(1/2*c)^
2 - a^2*d^4*x^4*imag_part(cos_integral(-d*x))*tan(1/2*d*x)^2*tan(1/2*c)^2
+ 2*a^2*d^4*x^4*sin_integral(d*x)*tan(1/2*d*x)^2*tan(1/2*c)^2 - 2*a^2*d^4*
x^4*real_part(cos_integral(d*x))*tan(1/2*d*x)^2*tan(1/2*c) - 2*a^2*d^4*x^4
*real_part(cos_integral(-d*x))*tan(1/2*d*x)^2*tan(1/2*c) - a^2*d^4*x^4*ima
g_part(cos_integral(d*x))*tan(1/2*d*x)^2 + a^2*d^4*x^4*imag_part(cos_integ
ral(-d*x))*tan(1/2*d*x)^2 - 2*a^2*d^4*x^4*sin_integral(d*x)*tan(1/2*d*x)^2
 + a^2*d^4*x^4*imag_part(cos_integral(d*x))*tan(1/2*c)^2 - a^2*d^4*x^4*ima
g_part(cos_integral(-d*x))*tan(1/2*c)^2 + 2*a^2*d^4*x^4*sin_integral(d*x)*
tan(1/2*c)^2 - 24*a*b*d^2*x^4*imag_part(cos_integral(d*x))*tan(1/2*d*x)^2*
tan(1/2*c)^2 + 24*a*b*d^2*x^4*imag_part(cos_integral(-d*x))*tan(1/2*d*x)^2
*tan(1/2*c)^2 - 48*a*b*d^2*x^4*sin_integral(d*x)*tan(1/2*d*x)^2*tan(1/2*c)
^2 - 2*a^2*d^4*x^4*real_part(cos_integral(d*x))*tan(1/2*c) - 2*a^2*d^4*x^4
*real_part(cos_integral(-d*x))*tan(1/2*c) + 48*a*b*d^2*x^4*real_part(cos_i
ntegral(d*x))*tan(1/2*d*x)^2*tan(1/2*c) + 48*a*b*d^2*x^4*real_part(cos_int
egral(-d*x))*tan(1/2*d*x)^2*tan(1/2*c) - 2*a^2*d^3*x^3*tan(1/2*d*x)^2*tan(
1/2*c)^2 - a^2*d^4*x^4*imag_part(cos_integral(d*x)) + a^2*d^4*x^4*imag_par
t(cos_integral(-d*x)) - 2*a^2*d^4*x^4*sin_integral(d*x) + 24*a*b*d^2*x^4*i
mag_part(cos_integral(d*x))*tan(1/2*d*x)^2 - 24*a*b*d^2*x^4*imag_part(cos_
integral(-d*x))*tan(1/2*d*x)^2 + 48*a*b*d^2*x^4*sin_integral(d*x)*tan(1...
```

### 3.56.9 Mupad [F(-1)]

Timed out.

$$\int \frac{(a+bx^2)^2 \sin(c+dx)}{x^5} \, dx = \int \frac{\sin(c+d\,x)\,\left(b\,x^2+a\right)^2}{x^5} \, dx$$

input
```
int((sin(c + d*x)*(a + b*x^2)^2)/x^5,x)
```

output
```
int((sin(c + d*x)*(a + b*x^2)^2)/x^5, x)
```

# 3.57 $\int \frac{x^4 \sin(c+dx)}{a+bx^2} dx$



## 3.57.1 Optimal result

Integrand size = 19, antiderivative size = 273

$$\int \frac{x^4 \sin(c+dx)}{a+bx^2} dx = \frac{2\cos(c+dx)}{bd^3} + \frac{a\cos(c+dx)}{b^2d} - \frac{x^2\cos(c+dx)}{bd} - \frac{(-a)^{3/2}\operatorname{CosIntegral}\left(\frac{\sqrt{-a}d}{\sqrt{b}}+dx\right)\sin\left(c-\frac{\sqrt{-a}d}{\sqrt{b}}\right)}{2b^{5/2}} + \frac{(-a)^{3/2}\operatorname{CosIntegral}\left(\frac{\sqrt{-a}d}{\sqrt{b}}-dx\right)\sin\left(c+\frac{\sqrt{-a}d}{\sqrt{b}}\right)}{2b^{5/2}} + \frac{2x\sin(c+dx)}{bd^2} - \frac{(-a)^{3/2}\cos\left(c+\frac{\sqrt{-a}d}{\sqrt{b}}\right)\operatorname{Si}\left(\frac{\sqrt{-a}d}{\sqrt{b}}-dx\right)}{2b^{5/2}} - \frac{(-a)^{3/2}\cos\left(c-\frac{\sqrt{-a}d}{\sqrt{b}}\right)\operatorname{Si}\left(\frac{\sqrt{-a}d}{\sqrt{b}}+dx\right)}{2b^{5/2}}$$

output
```
2*cos(d*x+c)/b/d^3+a*cos(d*x+c)/b^2/d-x^2*cos(d*x+c)/b/d+1/2*(-a)^(3/2)*co
s(c+d*(-a)^(1/2)/b^(1/2))*Si(d*x-d*(-a)^(1/2)/b^(1/2))/b^(5/2)-1/2*(-a)^(3
/2)*cos(c-d*(-a)^(1/2)/b^(1/2))*Si(d*x+d*(-a)^(1/2)/b^(1/2))/b^(5/2)+2*x*s
in(d*x+c)/b/d^2-1/2*(-a)^(3/2)*Ci(d*x+d*(-a)^(1/2)/b^(1/2))*sin(c-d*(-a)^(
1/2)/b^(1/2))/b^(5/2)+1/2*(-a)^(3/2)*Ci(-d*x+d*(-a)^(1/2)/b^(1/2))*sin(c+d
*(-a)^(1/2)/b^(1/2))/b^(5/2)
```

### 3.57.2 Mathematica [C] (verified)

Result contains complex when optimal does not.

Time = 1.46 (sec) , antiderivative size = 269, normalized size of antiderivative = 0.99

$$\int \frac{x^4 \sin(c+dx)}{a+bx^2} \, dx = \frac{e^{-ic-\frac{\sqrt{a}d}{\sqrt{b}}}\left(a^{3/2}d^3e^{\frac{2\sqrt{a}d}{\sqrt{b}}}\operatorname{ExpIntegralEi}\left(-\frac{\sqrt{a}d}{\sqrt{b}}-idx\right)-a^{3/2}d^3\operatorname{ExpIntegralEi}\left(\frac{\sqrt{a}d}{\sqrt{b}}-idx\right)+e^{ic}\left(a^{3/2}d^3e^{\frac{2\sqrt{c}}{\sqrt{b}}}\right.\right.}{}$$

input
```
Integrate[(x^4*Sin[c + d*x])/(a + b*x^2),x]
```

output
```
(E^((-I)*c - (Sqrt[a]*d)/Sqrt[b])*(a^(3/2)*d^3*E^((2*Sqrt[a]*d)/Sqrt[b])*E
xpIntegralEi[-((Sqrt[a]*d)/Sqrt[b]) - I*d*x] - a^(3/2)*d^3*ExpIntegralEi[(
Sqrt[a]*d)/Sqrt[b] - I*d*x] + E^(I*c)*(a^(3/2)*d^3*E^((2*Sqrt[a]*d)/Sqrt[b
])*ExpIntegralEi[-((Sqrt[a]*d)/Sqrt[b]) + I*d*x]*(Cos[c] + I*Sin[c]) - a^(
3/2)*d^3*ExpIntegralEi[(Sqrt[a]*d)/Sqrt[b] + I*d*x]*(Cos[c] + I*Sin[c]) -
4*Sqrt[b]*E^((Sqrt[a]*d)/Sqrt[b])*((-2*b - a*d^2 + b*d^2*x^2)*Cos[c + d*x]
 - 2*b*d*x*Sin[c + d*x]))))/(4*b^(5/2)*d^3)
```

### 3.57.3 Rubi [A] (verified)

Time = 0.83 (sec) , antiderivative size = 273, normalized size of antiderivative = 1.00, number of steps used = 2, number of rules used = 2, $\frac{\text{number of rules}}{\text{integrand size}}$ = 0.105, Rules used = {3826, 2009}

Below are the steps used by Rubi to obtain the solution. The rule number used for the transformation is given above next to the arrow. The rules definitions used are listed below.

$$\int \frac{x^4 \sin(c+dx)}{a+bx^2} \, dx$$

$$\Big\downarrow \text{3826}$$

$$\int \left(\frac{a^2 \sin(c+dx)}{b^2 (a+bx^2)} - \frac{a \sin(c+dx)}{b^2} + \frac{x^2 \sin(c+dx)}{b}\right) dx$$

$$\Big\downarrow \text{2009}$$

$$-\frac{(-a)^{3/2}\sin\left(c-\frac{\sqrt{-a}d}{\sqrt{b}}\right)\text{CosIntegral}\left(xd+\frac{\sqrt{-a}d}{\sqrt{b}}\right)}{2b^{5/2}}+\frac{(-a)^{3/2}\sin\left(\frac{\sqrt{-a}d}{\sqrt{b}}+c\right)\text{CosIntegral}\left(\frac{\sqrt{-a}d}{\sqrt{b}}-dx\right)}{2b^{5/2}}-\frac{(-a)^{3/2}\cos\left(\frac{\sqrt{-a}d}{\sqrt{b}}+c\right)\text{Si}\left(\frac{\sqrt{-a}d}{\sqrt{b}}-dx\right)}{2b^{5/2}}-\frac{(-a)^{3/2}\cos\left(c-\frac{\sqrt{-a}d}{\sqrt{b}}\right)\text{Si}\left(xd+\frac{\sqrt{-a}d}{\sqrt{b}}\right)}{2b^{5/2}}+\frac{a\cos(c+dx)}{b^2d}+\frac{2\cos(c+dx)}{bd^3}+\frac{2x\sin(c+dx)}{bd^2}-\frac{x^2\cos(c+dx)}{bd}$$

input
```
Int[(x^4*Sin[c + d*x])/(a + b*x^2),x]
```

output
```
(2*Cos[c + d*x])/(b*d^3) + (a*Cos[c + d*x])/(b^2*d) - (x^2*Cos[c + d*x])/(
b*d) - ((-a)^(3/2)*CosIntegral[(Sqrt[-a]*d)/Sqrt[b] + d*x]*Sin[c - (Sqrt[-
a]*d)/Sqrt[b]])/(2*b^(5/2)) + ((-a)^(3/2)*CosIntegral[(Sqrt[-a]*d)/Sqrt[b]
 - d*x]*Sin[c + (Sqrt[-a]*d)/Sqrt[b]])/(2*b^(5/2)) + (2*x*Sin[c + d*x])/(b
*d^2) - ((-a)^(3/2)*Cos[c + (Sqrt[-a]*d)/Sqrt[b]]*SinIntegral[(Sqrt[-a]*d)
/Sqrt[b] - d*x])/(2*b^(5/2)) - ((-a)^(3/2)*Cos[c - (Sqrt[-a]*d)/Sqrt[b]]*S
inIntegral[(Sqrt[-a]*d)/Sqrt[b] + d*x])/(2*b^(5/2))
```

### 3.57.3.1 Defintions of rubi rules used

rule 2009
```
Int[u_, x_Symbol] :> Simp[IntSum[u, x], x] /; SumQ[u]
```

rule 3826
```
Int[(x_)^(m_.)*((a_) + (b_.)*(x_)^(n_))^(p_)*Sin[(c_.) + (d_.)*(x_)], x_Sym
bol] :> Int[ExpandIntegrand[Sin[c + d*x], x^m*(a + b*x^n)^p, x], x] /; Free
Q[{a, b, c, d, m}, x] && ILtQ[p, 0] && IGtQ[n, 0] && (EqQ[n, 2] || EqQ[p, -
1]) && IntegerQ[m]
```

## 3.57.4 Maple [C] (verified)

Result contains complex when optimal does not.

Time = 0.52 (sec) , antiderivative size = 323, normalized size of antiderivative = 1.18

| method | result |
|---|---|
| risch | $-\frac{\sqrt{ab}\,\mathrm{e}^{\frac{icb+d\sqrt{ab}}{b}}\,\mathrm{Ei}_1\left(\frac{icb+d\sqrt{ab}-b(idx+ic)}{b}\right)a}{4b^3}+\frac{\sqrt{ab}\,\mathrm{e}^{\frac{icb-d\sqrt{ab}}{b}}\,\mathrm{Ei}_1\left(\frac{icb-d\sqrt{ab}-b(idx+ic)}{b}\right)a}{4b^3}+\frac{\mathrm{e}^{-\frac{icb+d\sqrt{ab}}{b}}\,\mathrm{Ei}_1\left(-\right.}{}$ |
| derivativedivides | Expression too large to display |
| default | Expression too large to display |

input
```
int(x^4*sin(d*x+c)/(b*x^2+a),x,method=_RETURNVERBOSE)
```

output
```
-1/4/b^3*(a*b)^(1/2)*exp((I*c*b+d*(a*b)^(1/2))/b)*Ei(1,(I*c*b+d*(a*b)^(1/2
)-b*(I*d*x+I*c))/b)*a+1/4/b^3*(a*b)^(1/2)*exp((I*c*b-d*(a*b)^(1/2))/b)*Ei(
1,(I*c*b-d*(a*b)^(1/2)-b*(I*d*x+I*c))/b)*a+1/4/b^3*exp(-(I*c*b+d*(a*b)^(1/
2))/b)*Ei(1,-(I*c*b+d*(a*b)^(1/2)-b*(I*d*x+I*c))/b)*(a*b)^(1/2)*a-1/4/b^3*
exp(-(I*c*b-d*(a*b)^(1/2))/b)*Ei(1,-(I*c*b-d*(a*b)^(1/2)-b*(I*d*x+I*c))/b)
*(a*b)^(1/2)*a-(b*d^2*x^2-a*d^2-2*b)/b^2/d^3*cos(d*x+c)-2/d^3/b*(d^2*x^2+3
*c*d*x)/(-d*x-3*c)*sin(d*x+c)
```

### 3.57.5 Fricas [C] (verification not implemented)

Result contains complex when optimal does not.

Time = 0.31 (sec) , antiderivative size = 240, normalized size of antiderivative = 0.88

$$\int \frac{x^4\sin(c+dx)}{a+bx^2}\,dx$$
$$=\frac{\sqrt{\frac{ad^2}{b}}ad^2\mathrm{Ei}\left(i\,dx-\sqrt{\frac{ad^2}{b}}\right)e^{\left(i\,c+\sqrt{\frac{ad^2}{b}}\right)}-\sqrt{\frac{ad^2}{b}}ad^2\mathrm{Ei}\left(i\,dx+\sqrt{\frac{ad^2}{b}}\right)e^{\left(i\,c-\sqrt{\frac{ad^2}{b}}\right)}+\sqrt{\frac{ad^2}{b}}ad^2\mathrm{Ei}\left(-i\,dx-\right.}{}$$

input
```
integrate(x^4*sin(d*x+c)/(b*x^2+a),x, algorithm="fricas")
```

output
```
1/4*(sqrt(a*d^2/b)*a*d^2*Ei(I*d*x - sqrt(a*d^2/b))*e^(I*c + sqrt(a*d^2/b))
 - sqrt(a*d^2/b)*a*d^2*Ei(I*d*x + sqrt(a*d^2/b))*e^(I*c - sqrt(a*d^2/b)) +
 sqrt(a*d^2/b)*a*d^2*Ei(-I*d*x - sqrt(a*d^2/b))*e^(-I*c + sqrt(a*d^2/b)) -
 sqrt(a*d^2/b)*a*d^2*Ei(-I*d*x + sqrt(a*d^2/b))*e^(-I*c - sqrt(a*d^2/b)) +
 8*b*d*x*sin(d*x + c) - 4*(b*d^2*x^2 - a*d^2 - 2*b)*cos(d*x + c))/(b^2*d^3
)
```

### 3.57.6 Sympy [F]

$$\int \frac{x^4 \sin(c+dx)}{a+bx^2} dx = \int \frac{x^4 \sin(c+dx)}{a+bx^2} dx$$

input
```
integrate(x**4*sin(d*x+c)/(b*x**2+a),x)
```

output
```
Integral(x**4*sin(c + d*x)/(a + b*x**2), x)
```

### 3.57.7 Maxima [F]

$$\int \frac{x^4 \sin(c+dx)}{a+bx^2} dx = \int \frac{x^4 \sin(dx+c)}{bx^2+a} dx$$

input
```
integrate(x^4*sin(d*x+c)/(b*x^2+a),x, algorithm="maxima")
```

output
```
-1/2*(((b*d^2*x^4*cos(c) + 2*b*d*x^3*sin(c) - 2*b*x^2*cos(c) + 2*a*d*x*sin
(c))*cos(d*x + c)^2 + (b*d^2*x^4*cos(c) + 2*b*d*x^3*sin(c) - 2*b*x^2*cos(c
) + 2*a*d*x*sin(c))*sin(d*x + c)^2)*cos(d*x + 2*c) + ((b*cos(c)^2 + b*sin(
c)^2)*d^2*x^4 - 2*(b*cos(c)^2 + b*sin(c)^2)*x^2)*cos(d*x + c) + 2*(((b^2*c
os(c)^2 + b^2*sin(c)^2)*d^3*x^2 + (a*b*cos(c)^2 + a*b*sin(c)^2)*d^3)*cos(d
*x + c)^2 + ((b^2*cos(c)^2 + b^2*sin(c)^2)*d^3*x^2 + (a*b*cos(c)^2 + a*b*s
in(c)^2)*d^3)*sin(d*x + c)^2)*integrate(((a^2*d^2 + 2*a*b)*x*cos(d*x + c)
+ (a*b*d*x^2 + a^2*d)*sin(d*x + c))/(b^3*d^3*x^4 + 2*a*b^2*d^3*x^2 + a^2*b
*d^3), x) + 2*(((b^2*cos(c)^2 + b^2*sin(c)^2)*d^3*x^2 + (a*b*cos(c)^2 + a*
b*sin(c)^2)*d^3)*cos(d*x + c)^2 + ((b^2*cos(c)^2 + b^2*sin(c)^2)*d^3*x^2 +
 (a*b*cos(c)^2 + a*b*sin(c)^2)*d^3)*sin(d*x + c)^2)*integrate(((a^2*d^2 +
2*a*b)*x*cos(d*x + c) + (a*b*d*x^2 + a^2*d)*sin(d*x + c))/((b^3*d^3*x^4 +
2*a*b^2*d^3*x^2 + a^2*b*d^3)*cos(d*x + c)^2 + (b^3*d^3*x^4 + 2*a*b^2*d^3*x
^2 + a^2*b*d^3)*sin(d*x + c)^2), x) + ((b*d^2*x^4*sin(c) - 2*b*d*x^3*cos(c
) - 2*a*d*x*cos(c) - 2*b*x^2*sin(c))*cos(d*x + c)^2 + (b*d^2*x^4*sin(c) -
2*b*d*x^3*cos(c) - 2*a*d*x*cos(c) - 2*b*x^2*sin(c))*sin(d*x + c)^2)*sin(d*
x + 2*c) - 2*((b*cos(c)^2 + b*sin(c)^2)*d*x^3 + (a*cos(c)^2 + a*sin(c)^2)*
d*x)*sin(d*x + c))/(((b^2*cos(c)^2 + b^2*sin(c)^2)*d^3*x^2 + (a*b*cos(c)^2
 + a*b*sin(c)^2)*d^3)*cos(d*x + c)^2 + ((b^2*cos(c)^2 + b^2*sin(c)^2)*d^3*
x^2 + (a*b*cos(c)^2 + a*b*sin(c)^2)*d^3)*sin(d*x + c)^2)
```

### 3.57.8 Giac [F]

$$\int \frac{x^4 \sin(c+dx)}{a+bx^2} \, dx = \int \frac{x^4 \sin(dx+c)}{bx^2+a} \, dx$$

input
```
integrate(x^4*sin(d*x+c)/(b*x^2+a),x, algorithm="giac")
```

output
```
integrate(x^4*sin(d*x + c)/(b*x^2 + a), x)
```

### 3.57.9 Mupad [F(-1)]

Timed out.

$$\int \frac{x^4 \sin(c+dx)}{a+bx^2} \, dx = \int \frac{x^4 \sin(c+d\,x)}{b\,x^2+a} \, dx$$

input
```
int((x^4*sin(c + d*x))/(a + b*x^2),x)
```

output
```
int((x^4*sin(c + d*x))/(a + b*x^2), x)
```

# 3.58 $\int \frac{x^3 \sin(c+dx)}{a+bx^2}\,dx$



## 3.58.1 Optimal result

Integrand size = 19, antiderivative size = 209

$$\int \frac{x^3 \sin(c+dx)}{a+bx^2}\,dx = -\frac{x\cos(c+dx)}{bd} - \frac{a\,\text{CosIntegral}\left(\frac{\sqrt{-a}d}{\sqrt{b}}+dx\right)\sin\left(c-\frac{\sqrt{-a}d}{\sqrt{b}}\right)}{2b^2} - \frac{a\,\text{CosIntegral}\left(\frac{\sqrt{-a}d}{\sqrt{b}}-dx\right)\sin\left(c+\frac{\sqrt{-a}d}{\sqrt{b}}\right)}{2b^2} + \frac{\sin(c+dx)}{bd^2} + \frac{a\cos\left(c+\frac{\sqrt{-a}d}{\sqrt{b}}\right)\text{Si}\left(\frac{\sqrt{-a}d}{\sqrt{b}}-dx\right)}{2b^2} - \frac{a\cos\left(c-\frac{\sqrt{-a}d}{\sqrt{b}}\right)\text{Si}\left(\frac{\sqrt{-a}d}{\sqrt{b}}+dx\right)}{2b^2}$$

output
```
-x*cos(d*x+c)/b/d-1/2*a*cos(c+d*(-a)^(1/2)/b^(1/2))*Si(d*x-d*(-a)^(1/2)/b^
(1/2))/b^2-1/2*a*cos(c-d*(-a)^(1/2)/b^(1/2))*Si(d*x+d*(-a)^(1/2)/b^(1/2))/
b^2+sin(d*x+c)/b/d^2-1/2*a*Ci(d*x+d*(-a)^(1/2)/b^(1/2))*sin(c-d*(-a)^(1/2)
/b^(1/2))/b^2-1/2*a*Ci(-d*x+d*(-a)^(1/2)/b^(1/2))*sin(c+d*(-a)^(1/2)/b^(1/
2))/b^2
```

### 3.58.2 Mathematica [C] (verified)

Result contains complex when optimal does not.

Time = 1.11 (sec) , antiderivative size = 214, normalized size of antiderivative = 1.02

$$\int \frac{x^3 \sin(c+dx)}{a+bx^2}\,dx$$
$$= \frac{-iae^{-ic-\frac{\sqrt{a}d}{\sqrt{b}}}\left(e^{\frac{2\sqrt{a}d}{\sqrt{b}}}\operatorname{ExpIntegralEi}\left(-\frac{\sqrt{a}d}{\sqrt{b}}-idx\right)+\operatorname{ExpIntegralEi}\left(\frac{\sqrt{a}d}{\sqrt{b}}-idx\right)\right)+iae^{ic-\frac{\sqrt{a}d}{\sqrt{b}}}\left(e^{\frac{2\sqrt{a}d}{\sqrt{b}}}\operatorname{ExpI}\right.}{4b}$$

input
```
Integrate[(x^3*Sin[c + d*x])/(a + b*x^2),x]
```

output
```
((-I)*a*E^((-I)*c - (Sqrt[a]*d)/Sqrt[b])*(E^((2*Sqrt[a]*d)/Sqrt[b])*ExpInt
egralEi[-((Sqrt[a]*d)/Sqrt[b]) - I*d*x] + ExpIntegralEi[(Sqrt[a]*d)/Sqrt[b
] - I*d*x]) + I*a*E^(I*c - (Sqrt[a]*d)/Sqrt[b])*(E^((2*Sqrt[a]*d)/Sqrt[b])
*ExpIntegralEi[-((Sqrt[a]*d)/Sqrt[b]) + I*d*x] + ExpIntegralEi[(Sqrt[a]*d)
/Sqrt[b] + I*d*x]) - (4*b*Cos[d*x]*(d*x*Cos[c] - Sin[c]))/d^2 + (4*b*(Cos[
c] + d*x*Sin[c])*Sin[d*x])/d^2)/(4*b^2)
```

### 3.58.3 Rubi [A] (verified)

Time = 0.54 (sec) , antiderivative size = 209, normalized size of antiderivative = 1.00, number of steps used = 2, number of rules used = 2, $\frac{\text{number of rules}}{\text{integrand size}}$ = 0.105, Rules used = {3826, 2009}

Below are the steps used by Rubi to obtain the solution. The rule number used for the transformation is given above next to the arrow. The rules definitions used are listed below.

$$\int \frac{x^3 \sin(c+dx)}{a+bx^2}\,dx$$
$$\Big\downarrow \text{3826}$$
$$\int \left(\frac{x\sin(c+dx)}{b}-\frac{ax\sin(c+dx)}{b(a+bx^2)}\right)dx$$
$$\Big\downarrow \text{2009}$$
$$-\frac{a\sin\left(c-\frac{\sqrt{-ad}}{\sqrt{b}}\right)\operatorname{CosIntegral}\left(xd+\frac{\sqrt{-ad}}{\sqrt{b}}\right)}{2b^2}-\frac{a\sin\left(\frac{\sqrt{-ad}}{\sqrt{b}}+c\right)\operatorname{CosIntegral}\left(\frac{\sqrt{-ad}}{\sqrt{b}}-dx\right)}{2b^2}+\frac{a\cos\left(\frac{\sqrt{-ad}}{\sqrt{b}}+c\right)\operatorname{Si}\left(\frac{\sqrt{-ad}}{\sqrt{b}}-dx\right)}{2b^2}-\frac{a\cos\left(c-\frac{\sqrt{-ad}}{\sqrt{b}}\right)\operatorname{Si}\left(xd+\frac{\sqrt{-ad}}{\sqrt{b}}\right)}{2b^2}+\frac{\sin(c+dx)}{bd^2}-\frac{x\cos(c+dx)}{bd}$$

input
```
Int[(x^3*Sin[c + d*x])/(a + b*x^2),x]
```

output
```
-((x*Cos[c + d*x])/(b*d)) - (a*CosIntegral[(Sqrt[-a]*d)/Sqrt[b] + d*x]*Sin
[c - (Sqrt[-a]*d)/Sqrt[b]])/(2*b^2) - (a*CosIntegral[(Sqrt[-a]*d)/Sqrt[b]
- d*x]*Sin[c + (Sqrt[-a]*d)/Sqrt[b]])/(2*b^2) + Sin[c + d*x]/(b*d^2) + (a*
Cos[c + (Sqrt[-a]*d)/Sqrt[b]]*SinIntegral[(Sqrt[-a]*d)/Sqrt[b] - d*x])/(2*
b^2) - (a*Cos[c - (Sqrt[-a]*d)/Sqrt[b]]*SinIntegral[(Sqrt[-a]*d)/Sqrt[b] +
 d*x])/(2*b^2)
```

### 3.58.3.1 Defintions of rubi rules used

rule 2009
```
Int[u_, x_Symbol] :> Simp[IntSum[u, x], x] /; SumQ[u]
```

rule 3826
```
Int[(x_)^(m_.)*((a_) + (b_.)*(x_)^(n_))^(p_)*Sin[(c_.) + (d_.)*(x_)], x_Sym
bol] :> Int[ExpandIntegrand[Sin[c + d*x], x^m*(a + b*x^n)^p, x], x] /; Free
Q[{a, b, c, d, m}, x] && ILtQ[p, 0] && IGtQ[n, 0] && (EqQ[n, 2] || EqQ[p, -
1]) && IntegerQ[m]
```

## 3.58.4 Maple [C] (verified)

Result contains complex when optimal does not.

Time = 0.38 (sec) , antiderivative size = 266, normalized size of antiderivative = 1.27

| method | result |
|---|---|
| risch | $-\frac{i\,\mathrm{Ei}_1\left(\frac{icb-d\sqrt{ab}-b(idx+ic)}{b}\right)\mathrm{e}^{\frac{icb-d\sqrt{ab}}{b}}a}{4b^2}-\frac{i\,\mathrm{Ei}_1\left(\frac{icb+d\sqrt{ab}-b(idx+ic)}{b}\right)\mathrm{e}^{\frac{icb+d\sqrt{ab}}{b}}a}{4b^2}+\frac{i\,\mathrm{Ei}_1\left(-\frac{icb-d\sqrt{ab}-b(idx+ic)}{b}\right.}{4b^2}$ |
| derivativedivides | Expression too large to display |
| default | Expression too large to display |

input
```
int(x^3*sin(d*x+c)/(b*x^2+a),x,method=_RETURNVERBOSE)
```

output
```
-1/4*I/b^2*Ei(1,(I*c*b-d*(a*b)^(1/2)-b*(I*d*x+I*c))/b)*exp((I*c*b-d*(a*b)^
(1/2))/b)*a-1/4*I/b^2*Ei(1,(I*c*b+d*(a*b)^(1/2)-b*(I*d*x+I*c))/b)*exp((I*c
*b+d*(a*b)^(1/2))/b)*a+1/4*I/b^2*Ei(1,-(I*c*b-d*(a*b)^(1/2)-b*(I*d*x+I*c))
/b)*exp(-(I*c*b-d*(a*b)^(1/2))/b)*a+1/4*I/b^2*Ei(1,-(I*c*b+d*(a*b)^(1/2)-b
*(I*d*x+I*c))/b)*exp(-(I*c*b+d*(a*b)^(1/2))/b)*a-x*cos(d*x+c)/b/d+sin(d*x+
c)/b/d^2
```

### 3.58.5 Fricas [C] (verification not implemented)

Result contains complex when optimal does not.

Time = 0.32 (sec) , antiderivative size = 185, normalized size of antiderivative = 0.89

$$\int \frac{x^3 \sin(c+dx)}{a+bx^2}\,dx$$
$$= \frac{i\,ad^2\text{Ei}\left(i\,dx-\sqrt{\frac{ad^2}{b}}\right)e^{\left(i\,c+\sqrt{\frac{ad^2}{b}}\right)}+i\,ad^2\text{Ei}\left(i\,dx+\sqrt{\frac{ad^2}{b}}\right)e^{\left(i\,c-\sqrt{\frac{ad^2}{b}}\right)}-i\,ad^2\text{Ei}\left(-i\,dx-\sqrt{\frac{ad^2}{b}}\right)e^{\left(-i\,c\cdots\right.}}{4\,b^2d^2}$$

input
```
integrate(x^3*sin(d*x+c)/(b*x^2+a),x, algorithm="fricas")
```

output
```
1/4*(I*a*d^2*Ei(I*d*x - sqrt(a*d^2/b))*e^(I*c + sqrt(a*d^2/b)) + I*a*d^2*E
i(I*d*x + sqrt(a*d^2/b))*e^(I*c - sqrt(a*d^2/b)) - I*a*d^2*Ei(-I*d*x - sqr
t(a*d^2/b))*e^(-I*c + sqrt(a*d^2/b)) - I*a*d^2*Ei(-I*d*x + sqrt(a*d^2/b))*
e^(-I*c - sqrt(a*d^2/b)) - 4*b*d*x*cos(d*x + c) + 4*b*sin(d*x + c))/(b^2*d
^2)
```

### 3.58.6 Sympy [F]

$$\int \frac{x^3 \sin(c+dx)}{a+bx^2}\,dx = \int \frac{x^3 \sin(c+dx)}{a+bx^2}\,dx$$

input
```
integrate(x**3*sin(d*x+c)/(b*x**2+a),x)
```

output
```
Integral(x**3*sin(c + d*x)/(a + b*x**2), x)
```

### 3.58.7 Maxima [F]

$$\int \frac{x^3 \sin(c+dx)}{a+bx^2} \, dx = \int \frac{x^3 \sin(dx+c)}{bx^2+a} \, dx$$

input
```
integrate(x^3*sin(d*x+c)/(b*x^2+a),x, algorithm="maxima")
```

output
```
-1/2*((cos(c)^2 + sin(c)^2)*d*x^3*cos(d*x + c) - (cos(c)^2 + sin(c)^2)*x^2
*sin(d*x + c) + ((d*x^3*cos(c) + x^2*sin(c))*cos(d*x + c)^2 + (d*x^3*cos(c
) + x^2*sin(c))*sin(d*x + c)^2)*cos(d*x + 2*c) + 2*(((b*cos(c)^2 + b*sin(c
)^2)*d^2*x^2 + (a*cos(c)^2 + a*sin(c)^2)*d^2)*cos(d*x + c)^2 + ((b*cos(c)^
2 + b*sin(c)^2)*d^2*x^2 + (a*cos(c)^2 + a*sin(c)^2)*d^2)*sin(d*x + c)^2)*i
ntegrate(-(a*d*x^2*cos(d*x + c) - a*x*sin(d*x + c))/(b^2*d^2*x^4 + 2*a*b*d
^2*x^2 + a^2*d^2), x) + 2*(((b*cos(c)^2 + b*sin(c)^2)*d^2*x^2 + (a*cos(c)^
2 + a*sin(c)^2)*d^2)*cos(d*x + c)^2 + ((b*cos(c)^2 + b*sin(c)^2)*d^2*x^2 +
 (a*cos(c)^2 + a*sin(c)^2)*d^2)*sin(d*x + c)^2)*integrate(-(a*d*x^2*cos(d*
x + c) - a*x*sin(d*x + c))/((b^2*d^2*x^4 + 2*a*b*d^2*x^2 + a^2*d^2)*cos(d*
x + c)^2 + (b^2*d^2*x^4 + 2*a*b*d^2*x^2 + a^2*d^2)*sin(d*x + c)^2), x) + (
(d*x^3*sin(c) - x^2*cos(c))*cos(d*x + c)^2 + (d*x^3*sin(c) - x^2*cos(c))*s
in(d*x + c)^2)*sin(d*x + 2*c))/(((b*cos(c)^2 + b*sin(c)^2)*d^2*x^2 + (a*co
s(c)^2 + a*sin(c)^2)*d^2)*cos(d*x + c)^2 + ((b*cos(c)^2 + b*sin(c)^2)*d^2*
x^2 + (a*cos(c)^2 + a*sin(c)^2)*d^2)*sin(d*x + c)^2)
```

### 3.58.8 Giac [F]

$$\int \frac{x^3 \sin(c+dx)}{a+bx^2} \, dx = \int \frac{x^3 \sin(dx+c)}{bx^2+a} \, dx$$

input
```
integrate(x^3*sin(d*x+c)/(b*x^2+a),x, algorithm="giac")
```

output
```
integrate(x^3*sin(d*x + c)/(b*x^2 + a), x)
```

### 3.58.9 Mupad [F(-1)]

Timed out.

$$\int \frac{x^3 \sin(c+dx)}{a+bx^2}\,dx = \int \frac{x^3\,\sin(c+d\,x)}{b\,x^2+a}\,dx$$

input
```
int((x^3*sin(c + d*x))/(a + b*x^2),x)
```

output
```
int((x^3*sin(c + d*x))/(a + b*x^2), x)
```

# 3.59 $\int \frac{x^2 \sin(c+dx)}{a+bx^2} \, dx$



## 3.59.1 Optimal result

Integrand size = 19, antiderivative size = 227

$$\int \frac{x^2 \sin(c+dx)}{a+bx^2} \, dx = -\frac{\cos(c+dx)}{bd} - \frac{\sqrt{-a}\,\text{CosIntegral}\left(\frac{\sqrt{-a}d}{\sqrt{b}}+dx\right)\sin\left(c-\frac{\sqrt{-a}d}{\sqrt{b}}\right)}{2b^{3/2}} + \frac{\sqrt{-a}\,\text{CosIntegral}\left(\frac{\sqrt{-a}d}{\sqrt{b}}-dx\right)\sin\left(c+\frac{\sqrt{-a}d}{\sqrt{b}}\right)}{2b^{3/2}} - \frac{\sqrt{-a}\cos\left(c+\frac{\sqrt{-a}d}{\sqrt{b}}\right)\text{Si}\left(\frac{\sqrt{-a}d}{\sqrt{b}}-dx\right)}{2b^{3/2}} - \frac{\sqrt{-a}\cos\left(c-\frac{\sqrt{-a}d}{\sqrt{b}}\right)\text{Si}\left(\frac{\sqrt{-a}d}{\sqrt{b}}+dx\right)}{2b^{3/2}}$$

output
```
-cos(d*x+c)/b/d+1/2*cos(c+d*(-a)^(1/2)/b^(1/2))*Si(d*x-d*(-a)^(1/2)/b^(1/2
))*(-a)^(1/2)/b^(3/2)-1/2*cos(c-d*(-a)^(1/2)/b^(1/2))*Si(d*x+d*(-a)^(1/2)/
b^(1/2))*(-a)^(1/2)/b^(3/2)-1/2*Ci(d*x+d*(-a)^(1/2)/b^(1/2))*sin(c-d*(-a)^
(1/2)/b^(1/2))*(-a)^(1/2)/b^(3/2)+1/2*Ci(-d*x+d*(-a)^(1/2)/b^(1/2))*sin(c+
d*(-a)^(1/2)/b^(1/2))*(-a)^(1/2)/b^(3/2)
```

### 3.59.2 Mathematica [C] (verified)

Result contains complex when optimal does not.

Time = 0.65 (sec) , antiderivative size = 216, normalized size of antiderivative = 0.95

$$\int \frac{x^2 \sin(c+dx)}{a+bx^2} dx$$
$$= -\frac{\cos(c)\cos(dx)}{bd}$$
$$+ \frac{\sqrt{a}e^{-ic-\frac{\sqrt{a}d}{\sqrt{b}}}\left(-e^{\frac{2\sqrt{a}d}{\sqrt{b}}}\text{ExpIntegralEi}\left(-\frac{\sqrt{a}d}{\sqrt{b}}-idx\right)+\text{ExpIntegralEi}\left(\frac{\sqrt{a}d}{\sqrt{b}}-idx\right)\right)}{4b^{3/2}}$$
$$+ \frac{\sqrt{a}e^{ic-\frac{\sqrt{a}d}{\sqrt{b}}}\left(-e^{\frac{2\sqrt{a}d}{\sqrt{b}}}\text{ExpIntegralEi}\left(-\frac{\sqrt{a}d}{\sqrt{b}}+idx\right)+\text{ExpIntegralEi}\left(\frac{\sqrt{a}d}{\sqrt{b}}+idx\right)\right)}{4b^{3/2}}$$
$$+ \frac{\sin(c)\sin(dx)}{bd}$$

input
```
Integrate[(x^2*Sin[c + d*x])/(a + b*x^2),x]
```

output
```
-((Cos[c]*Cos[d*x])/(b*d)) + (Sqrt[a]*E^((-I)*c - (Sqrt[a]*d)/Sqrt[b])*(-(
E^((2*Sqrt[a]*d)/Sqrt[b])*ExpIntegralEi[-((Sqrt[a]*d)/Sqrt[b]) - I*d*x]) +
 ExpIntegralEi[(Sqrt[a]*d)/Sqrt[b] - I*d*x]))/(4*b^(3/2)) + (Sqrt[a]*E^(I*
c - (Sqrt[a]*d)/Sqrt[b])*(-(E^((2*Sqrt[a]*d)/Sqrt[b])*ExpIntegralEi[-((Sqr
t[a]*d)/Sqrt[b]) + I*d*x]) + ExpIntegralEi[(Sqrt[a]*d)/Sqrt[b] + I*d*x]))/
(4*b^(3/2)) + (Sin[c]*Sin[d*x])/(b*d)
```

### 3.59.3 Rubi [A] (verified)

Time = 0.51 (sec) , antiderivative size = 227, normalized size of antiderivative = 1.00, number of steps used = 2, number of rules used = 2, $\frac{\text{number of rules}}{\text{integrand size}}$ = 0.105, Rules used = {3826, 2009}

Below are the steps used by Rubi to obtain the solution. The rule number used for the transformation is given above next to the arrow. The rules definitions used are listed below.

$$\int \frac{x^2 \sin(c+dx)}{a+bx^2} dx$$
$$\Big\downarrow \text{3826}$$
$$\int \left(\frac{\sin(c+dx)}{b}-\frac{a\sin(c+dx)}{b\left(a+bx^2\right)}\right)dx$$

$$\Big\downarrow \text{2009}$$

$$-\frac{\sqrt{-a}\sin\left(c-\frac{\sqrt{-a}d}{\sqrt{b}}\right)\text{CosIntegral}\left(xd+\frac{\sqrt{-a}d}{\sqrt{b}}\right)}{2b^{3/2}}+\frac{\sqrt{-a}\sin\left(\frac{\sqrt{-a}d}{\sqrt{b}}+c\right)\text{CosIntegral}\left(\frac{\sqrt{-a}d}{\sqrt{b}}-dx\right)}{2b^{3/2}}-\frac{\sqrt{-a}\cos\left(\frac{\sqrt{-a}d}{\sqrt{b}}+c\right)\text{Si}\left(\frac{\sqrt{-a}d}{\sqrt{b}}-dx\right)}{2b^{3/2}}-\frac{\sqrt{-a}\cos\left(c-\frac{\sqrt{-a}d}{\sqrt{b}}\right)\text{Si}\left(xd+\frac{\sqrt{-a}d}{\sqrt{b}}\right)}{2b^{3/2}}-\frac{\cos(c+dx)}{bd}$$

input
```
Int[(x^2*Sin[c + d*x])/(a + b*x^2),x]
```

output
```
-(Cos[c + d*x]/(b*d)) - (Sqrt[-a]*CosIntegral[(Sqrt[-a]*d)/Sqrt[b] + d*x]*
Sin[c - (Sqrt[-a]*d)/Sqrt[b]])/(2*b^(3/2)) + (Sqrt[-a]*CosIntegral[(Sqrt[-
a]*d)/Sqrt[b] - d*x]*Sin[c + (Sqrt[-a]*d)/Sqrt[b]])/(2*b^(3/2)) - (Sqrt[-a
]*Cos[c + (Sqrt[-a]*d)/Sqrt[b]]*SinIntegral[(Sqrt[-a]*d)/Sqrt[b] - d*x])/(
2*b^(3/2)) - (Sqrt[-a]*Cos[c - (Sqrt[-a]*d)/Sqrt[b]]*SinIntegral[(Sqrt[-a]
*d)/Sqrt[b] + d*x])/(2*b^(3/2))
```

### 3.59.3.1 Defintions of rubi rules used

rule 2009
```
Int[u_, x_Symbol] :> Simp[IntSum[u, x], x] /; SumQ[u]
```

rule 3826
```
Int[(x_)^(m_.)*((a_) + (b_.)*(x_)^(n_))^(p_)*Sin[(c_.) + (d_.)*(x_)], x_Sym
bol] :> Int[ExpandIntegrand[Sin[c + d*x], x^m*(a + b*x^n)^p, x], x] /; Free
Q[{a, b, c, d, m}, x] && ILtQ[p, 0] && IGtQ[n, 0] && (EqQ[n, 2] || EqQ[p, -
1]) && IntegerQ[m]
```

## 3.59.4 Maple [C] (verified)

Result contains complex when optimal does not.

Time = 0.31 (sec) , antiderivative size = 264, normalized size of antiderivative = 1.16

| method | result |
|---|---|
| risch | $\frac{\sqrt{ab}\,\mathrm{e}^{\frac{icb+d\sqrt{ab}}{b}}\,\mathrm{Ei}_1\left(\frac{icb+d\sqrt{ab}-b(idx+ic)}{b}\right)}{4b^2}-\frac{\sqrt{ab}\,\mathrm{e}^{\frac{icb-d\sqrt{ab}}{b}}\,\mathrm{Ei}_1\left(\frac{icb-d\sqrt{ab}-b(idx+ic)}{b}\right)}{4b^2}-\frac{\mathrm{e}^{-\frac{icb+d\sqrt{ab}}{b}}\,\mathrm{Ei}_1\left(-\frac{icb+d\sqrt{\ldots}}{}\right)}{4b^2}$ |
| derivativedivides | $d^2c^2\left(-\frac{\mathrm{Si}\left(dx+c-\frac{d\sqrt{-ab}+cb}{b}\right)\cos\left(\frac{d\sqrt{-ab}+cb}{b}\right)+\mathrm{Ci}\left(dx+c-\frac{d\sqrt{-ab}+cb}{b}\right)\sin\left(\frac{d\sqrt{-ab}+cb}{b}\right)}{2b\left(-\frac{d\sqrt{-ab}+cb}{b}+c\right)}-\frac{\mathrm{Si}\left(dx+c+\frac{d\sqrt{-ab}-cb}{b}\right)\cos\left(\frac{d\sqrt{-\ldots}}{}\right)}{2\ldots}\right.$ |
| default | $d^2c^2\left(-\frac{\mathrm{Si}\left(dx+c-\frac{d\sqrt{-ab}+cb}{b}\right)\cos\left(\frac{d\sqrt{-ab}+cb}{b}\right)+\mathrm{Ci}\left(dx+c-\frac{d\sqrt{-ab}+cb}{b}\right)\sin\left(\frac{d\sqrt{-ab}+cb}{b}\right)}{2b\left(-\frac{d\sqrt{-ab}+cb}{b}+c\right)}-\frac{\mathrm{Si}\left(dx+c+\frac{d\sqrt{-ab}-cb}{b}\right)\cos\left(\frac{d\sqrt{-\ldots}}{}\right)}{2\ldots}\right.$ |

input
```
int(x^2*sin(d*x+c)/(b*x^2+a),x,method=_RETURNVERBOSE)
```

output
```
1/4/b^2*(a*b)^(1/2)*exp((I*c*b+d*(a*b)^(1/2))/b)*Ei(1,(I*c*b+d*(a*b)^(1/2)
-b*(I*d*x+I*c))/b)-1/4/b^2*(a*b)^(1/2)*exp((I*c*b-d*(a*b)^(1/2))/b)*Ei(1,(
I*c*b-d*(a*b)^(1/2)-b*(I*d*x+I*c))/b)-1/4/b^2*exp(-(I*c*b+d*(a*b)^(1/2))/b
)*Ei(1,-(I*c*b+d*(a*b)^(1/2)-b*(I*d*x+I*c))/b)*(a*b)^(1/2)+1/4/b^2*exp(-(I
*c*b-d*(a*b)^(1/2))/b)*Ei(1,-(I*c*b-d*(a*b)^(1/2)-b*(I*d*x+I*c))/b)*(a*b)^
(1/2)-cos(d*x+c)/b/d
```

### 3.59.5 Fricas [C] (verification not implemented)

Result contains complex when optimal does not.

Time = 0.31 (sec) , antiderivative size = 195, normalized size of antiderivative = 0.86

$$\int \frac{x^2\sin(c+dx)}{a+bx^2}\,dx =$$
$$-\frac{\sqrt{\frac{ad^2}{b}}\mathrm{Ei}\left(i\,dx-\sqrt{\frac{ad^2}{b}}\right)e^{\left(ic+\sqrt{\frac{ad^2}{b}}\right)}-\sqrt{\frac{ad^2}{b}}\mathrm{Ei}\left(i\,dx+\sqrt{\frac{ad^2}{b}}\right)e^{\left(ic-\sqrt{\frac{ad^2}{b}}\right)}+\sqrt{\frac{ad^2}{b}}\mathrm{Ei}\left(-i\,dx-\sqrt{\frac{ad^2}{b}}\right)e\ldots}{4\,bd}$$

input
```
integrate(x^2*sin(d*x+c)/(b*x^2+a),x, algorithm="fricas")
```

output
```
-1/4*(sqrt(a*d^2/b)*Ei(I*d*x - sqrt(a*d^2/b))*e^(I*c + sqrt(a*d^2/b)) - sq
rt(a*d^2/b)*Ei(I*d*x + sqrt(a*d^2/b))*e^(I*c - sqrt(a*d^2/b)) + sqrt(a*d^2
/b)*Ei(-I*d*x - sqrt(a*d^2/b))*e^(-I*c + sqrt(a*d^2/b)) - sqrt(a*d^2/b)*Ei
(-I*d*x + sqrt(a*d^2/b))*e^(-I*c - sqrt(a*d^2/b)) + 4*cos(d*x + c))/(b*d)
```

### 3.59.6 Sympy [F]

$$\int \frac{x^2 \sin(c+dx)}{a+bx^2} \, dx = \int \frac{x^2 \sin{(c+dx)}}{a+bx^2} \, dx$$

input
```
integrate(x**2*sin(d*x+c)/(b*x**2+a),x)
```

output
```
Integral(x**2*sin(c + d*x)/(a + b*x**2), x)
```

### 3.59.7 Maxima [F]

$$\int \frac{x^2 \sin(c+dx)}{a+bx^2} \, dx = \int \frac{x^2 \sin{(dx+c)}}{bx^2+a} \, dx$$

input
```
integrate(x^2*sin(d*x+c)/(b*x^2+a),x, algorithm="maxima")
```

output
```
-1/2*((cos(c)^2 + sin(c)^2)*x^2*cos(d*x + c) + (x^2*cos(d*x + c)^2*cos(c)
+ x^2*cos(c)*sin(d*x + c)^2)*cos(d*x + 2*c) - 2*(((a*b*cos(c)^2 + a*b*sin(
c)^2)*d*x^2 + (a^2*cos(c)^2 + a^2*sin(c)^2)*d)*cos(d*x + c)^2 + ((a*b*cos(
c)^2 + a*b*sin(c)^2)*d*x^2 + (a^2*cos(c)^2 + a^2*sin(c)^2)*d)*sin(d*x + c)
^2)*integrate(x*cos(d*x + c)/(b^2*d*x^4 + 2*a*b*d*x^2 + a^2*d), x) - 2*(((
a*b*cos(c)^2 + a*b*sin(c)^2)*d*x^2 + (a^2*cos(c)^2 + a^2*sin(c)^2)*d)*cos(
d*x + c)^2 + ((a*b*cos(c)^2 + a*b*sin(c)^2)*d*x^2 + (a^2*cos(c)^2 + a^2*si
n(c)^2)*d)*sin(d*x + c)^2)*integrate(x*cos(d*x + c)/((b^2*d*x^4 + 2*a*b*d*
x^2 + a^2*d)*cos(d*x + c)^2 + (b^2*d*x^4 + 2*a*b*d*x^2 + a^2*d)*sin(d*x +
c)^2), x) + (x^2*cos(d*x + c)^2*sin(c) + x^2*sin(d*x + c)^2*sin(c))*sin(d*
x + 2*c))/(((b*cos(c)^2 + b*sin(c)^2)*d*x^2 + (a*cos(c)^2 + a*sin(c)^2)*d)
*cos(d*x + c)^2 + ((b*cos(c)^2 + b*sin(c)^2)*d*x^2 + (a*cos(c)^2 + a*sin(c
)^2)*d)*sin(d*x + c)^2)
```

### 3.59.8 Giac [F]

$$\int \frac{x^2 \sin(c+dx)}{a+bx^2} \, dx = \int \frac{x^2 \sin{(dx+c)}}{bx^2+a} \, dx$$

input
```
integrate(x^2*sin(d*x+c)/(b*x^2+a),x, algorithm="giac")
```

output
```
integrate(x^2*sin(d*x + c)/(b*x^2 + a), x)
```

### 3.59.9 Mupad [F(-1)]

Timed out.

$$\int \frac{x^2 \sin(c+dx)}{a+bx^2} \, dx = \int \frac{x^2 \sin{(c+d\,x)}}{b\,x^2+a} \, dx$$

input
```
int((x^2*sin(c + d*x))/(a + b*x^2),x)
```

output
```
int((x^2*sin(c + d*x))/(a + b*x^2), x)
```

# 3.60 $\int \frac{x \sin(c+dx)}{a+bx^2} dx$



## 3.60.1 Optimal result

Integrand size = 17, antiderivative size = 177

$$\int \frac{x \sin(c+dx)}{a+bx^2} dx = \frac{\text{CosIntegral}\left(\frac{\sqrt{-a}d}{\sqrt{b}}+dx\right)\sin\left(c-\frac{\sqrt{-a}d}{\sqrt{b}}\right)}{2b} + \frac{\text{CosIntegral}\left(\frac{\sqrt{-a}d}{\sqrt{b}}-dx\right)\sin\left(c+\frac{\sqrt{-a}d}{\sqrt{b}}\right)}{2b} - \frac{\cos\left(c+\frac{\sqrt{-a}d}{\sqrt{b}}\right)\text{Si}\left(\frac{\sqrt{-a}d}{\sqrt{b}}-dx\right)}{2b} + \frac{\cos\left(c-\frac{\sqrt{-a}d}{\sqrt{b}}\right)\text{Si}\left(\frac{\sqrt{-a}d}{\sqrt{b}}+dx\right)}{2b}$$

output
```
1/2*cos(c+d*(-a)^(1/2)/b^(1/2))*Si(d*x-d*(-a)^(1/2)/b^(1/2))/b+1/2*cos(c-d
*(-a)^(1/2)/b^(1/2))*Si(d*x+d*(-a)^(1/2)/b^(1/2))/b+1/2*Ci(d*x+d*(-a)^(1/2
)/b^(1/2))*sin(c-d*(-a)^(1/2)/b^(1/2))/b+1/2*Ci(-d*x+d*(-a)^(1/2)/b^(1/2))
*sin(c+d*(-a)^(1/2)/b^(1/2))/b
```

## 3.60.2 Mathematica [C] (verified)

Result contains complex when optimal does not.

Time = 0.28 (sec) , antiderivative size = 155, normalized size of antiderivative = 0.88

$$\int \frac{x \sin(c+dx)}{a+bx^2} dx = \frac{ie^{-ic-\frac{\sqrt{a}d}{\sqrt{b}}}\left(e^{\frac{2\sqrt{a}d}{\sqrt{b}}}\text{ExpIntegralEi}\left(-\frac{\sqrt{a}d}{\sqrt{b}}-idx\right)+\text{ExpIntegralEi}\left(\frac{\sqrt{a}d}{\sqrt{b}}-idx\right)-e^{2ic}\left(e^{\frac{2\sqrt{a}d}{\sqrt{b}}}\text{ExpIntegralEi}\right.\right.}{4b}$$

input
```
Integrate[(x*Sin[c + d*x])/(a + b*x^2),x]
```

output
```
((I/4)*E^((-I)*c - (Sqrt[a]*d)/Sqrt[b])*(E^((2*Sqrt[a]*d)/Sqrt[b])*ExpInte
gralEi[-((Sqrt[a]*d)/Sqrt[b]) - I*d*x] + ExpIntegralEi[(Sqrt[a]*d)/Sqrt[b]
 - I*d*x] - E^((2*I)*c)*(E^((2*Sqrt[a]*d)/Sqrt[b])*ExpIntegralEi[-((Sqrt[a
]*d)/Sqrt[b]) + I*d*x] + ExpIntegralEi[(Sqrt[a]*d)/Sqrt[b] + I*d*x])))/b
```

### 3.60.3 Rubi [A] (verified)

Time = 0.42 (sec) , antiderivative size = 177, normalized size of antiderivative = 1.00, number of steps used = 2, number of rules used = 2, $\frac{\text{number of rules}}{\text{integrand size}}$ = 0.118, Rules used = {3826, 2009}

Below are the steps used by Rubi to obtain the solution. The rule number used for the transformation is given above next to the arrow. The rules definitions used are listed below.

$$\int \frac{x\sin(c+dx)}{a+bx^2}dx$$

$$\Big\downarrow \text{ 3826}$$

$$\int \left(\frac{\sin(c+dx)}{2\sqrt{b}\left(\sqrt{-a}+\sqrt{b}x\right)}-\frac{\sin(c+dx)}{2\sqrt{b}\left(\sqrt{-a}-\sqrt{b}x\right)}\right)dx$$

$$\Big\downarrow \text{ 2009}$$

$$\frac{\sin\left(c-\frac{\sqrt{-a}d}{\sqrt{b}}\right)\text{CosIntegral}\left(xd+\frac{\sqrt{-a}d}{\sqrt{b}}\right)}{2b}+\frac{\sin\left(\frac{\sqrt{-a}d}{\sqrt{b}}+c\right)\text{CosIntegral}\left(\frac{\sqrt{-a}d}{\sqrt{b}}-dx\right)}{2b}-\frac{\cos\left(\frac{\sqrt{-a}d}{\sqrt{b}}+c\right)\text{Si}\left(\frac{\sqrt{-a}d}{\sqrt{b}}-dx\right)}{2b}+\frac{\cos\left(c-\frac{\sqrt{-a}d}{\sqrt{b}}\right)\text{Si}\left(xd+\frac{\sqrt{-a}d}{\sqrt{b}}\right)}{2b}$$

input
```
Int[(x*Sin[c + d*x])/(a + b*x^2),x]
```

output
```
(CosIntegral[(Sqrt[-a]*d)/Sqrt[b] + d*x]*Sin[c - (Sqrt[-a]*d)/Sqrt[b]])/(2
*b) + (CosIntegral[(Sqrt[-a]*d)/Sqrt[b] - d*x]*Sin[c + (Sqrt[-a]*d)/Sqrt[b
]])/(2*b) - (Cos[c + (Sqrt[-a]*d)/Sqrt[b]]*SinIntegral[(Sqrt[-a]*d)/Sqrt[b
] - d*x])/(2*b) + (Cos[c - (Sqrt[-a]*d)/Sqrt[b]]*SinIntegral[(Sqrt[-a]*d)/
Sqrt[b] + d*x])/(2*b)
```

#### 3.60.3.1 Defintions of rubi rules used

rule 2009
```
Int[u_, x_Symbol] :> Simp[IntSum[u, x], x] /; SumQ[u]
```

rule 3826
```
Int[(x_)^(m_.)*((a_) + (b_.)*(x_)^(n_))^(p_)*Sin[(c_.) + (d_.)*(x_)], x_Sym
bol] :> Int[ExpandIntegrand[Sin[c + d*x], x^m*(a + b*x^n)^p, x], x] /; Free
Q[{a, b, c, d, m}, x] && ILtQ[p, 0] && IGtQ[n, 0] && (EqQ[n, 2] || EqQ[p, -
1]) && IntegerQ[m]
```

### 3.60.4 Maple [C] (verified)

Result contains complex when optimal does not.

Time = 0.26 (sec) , antiderivative size = 234, normalized size of antiderivative = 1.32

| method | result |
|---|---|
| risch | $\frac{i\mathrm{e}^{\frac{icb+d\sqrt{ab}}{b}}\operatorname{Ei}_1\left(\frac{icb+d\sqrt{ab}-b(idx+ic)}{b}\right)}{4b}+\frac{i\mathrm{e}^{\frac{icb-d\sqrt{ab}}{b}}\operatorname{Ei}_1\left(\frac{icb-d\sqrt{ab}-b(idx+ic)}{b}\right)}{4b}-\frac{i\operatorname{Ei}_1\left(-\frac{icb+d\sqrt{ab}-b(idx+ic)}{b}\right)\mathrm{e}^{-\frac{ic}{}}}{4b}$ |
| derivativedivides | $-\frac{d^2(d\sqrt{-ab}+cb)\left(\operatorname{Si}\left(dx+c-\frac{d\sqrt{-ab}+cb}{b}\right)\cos\left(\frac{d\sqrt{-ab}+cb}{b}\right)+\operatorname{Ci}\left(dx+c-\frac{d\sqrt{-ab}+cb}{b}\right)\sin\left(\frac{d\sqrt{-ab}+cb}{b}\right)\right)}{2b^2\left(-\frac{d\sqrt{-ab}+cb}{b}+c\right)}+\frac{d^2(d\sqrt{-ab}-cb)\left(\operatorname{Si}\left(dx\right.\right.}{}$ |
| default | $-\frac{d^2(d\sqrt{-ab}+cb)\left(\operatorname{Si}\left(dx+c-\frac{d\sqrt{-ab}+cb}{b}\right)\cos\left(\frac{d\sqrt{-ab}+cb}{b}\right)+\operatorname{Ci}\left(dx+c-\frac{d\sqrt{-ab}+cb}{b}\right)\sin\left(\frac{d\sqrt{-ab}+cb}{b}\right)\right)}{2b^2\left(-\frac{d\sqrt{-ab}+cb}{b}+c\right)}+\frac{d^2(d\sqrt{-ab}-cb)\left(\operatorname{Si}\left(dx\right.\right.}{}$ |

input
```
int(x*sin(d*x+c)/(b*x^2+a),x,method=_RETURNVERBOSE)
```

output
```
1/4*I/b*exp((I*c*b+d*(a*b)^(1/2))/b)*Ei(1,(I*c*b+d*(a*b)^(1/2)-b*(I*d*x+I*
c))/b)+1/4*I/b*exp((I*c*b-d*(a*b)^(1/2))/b)*Ei(1,(I*c*b-d*(a*b)^(1/2)-b*(I
*d*x+I*c))/b)-1/4*I/b*Ei(1,-(I*c*b+d*(a*b)^(1/2)-b*(I*d*x+I*c))/b)*exp(-(I
*c*b+d*(a*b)^(1/2))/b)-1/4*I/b*Ei(1,-(I*c*b-d*(a*b)^(1/2)-b*(I*d*x+I*c))/b
)*exp(-(I*c*b-d*(a*b)^(1/2))/b)
```

### 3.60.5 Fricas [C] (verification not implemented)

Result contains complex when optimal does not.

Time = 0.29 (sec) , antiderivative size = 146, normalized size of antiderivative = 0.82

$$\int \frac{x\sin(c+dx)}{a+bx^2}\,dx = \frac{-i\,\mathrm{Ei}\left(i\,dx-\sqrt{\frac{ad^2}{b}}\right)e^{\left(i\,c+\sqrt{\frac{ad^2}{b}}\right)} - i\,\mathrm{Ei}\left(i\,dx+\sqrt{\frac{ad^2}{b}}\right)e^{\left(i\,c-\sqrt{\frac{ad^2}{b}}\right)} + i\,\mathrm{Ei}\left(-i\,dx-\sqrt{\frac{ad^2}{b}}\right)e^{\left(-i\,c+\sqrt{\frac{ad^2}{b}}\right)} -}{4\,b}$$

input
```
integrate(x*sin(d*x+c)/(b*x^2+a),x, algorithm="fricas")
```

output
```
1/4*(-I*Ei(I*d*x - sqrt(a*d^2/b))*e^(I*c + sqrt(a*d^2/b)) - I*Ei(I*d*x + s
qrt(a*d^2/b))*e^(I*c - sqrt(a*d^2/b)) + I*Ei(-I*d*x - sqrt(a*d^2/b))*e^(-I
*c + sqrt(a*d^2/b)) + I*Ei(-I*d*x + sqrt(a*d^2/b))*e^(-I*c - sqrt(a*d^2/b)
))/b
```

### 3.60.6 Sympy [F]

$$\int \frac{x\sin(c+dx)}{a+bx^2}\,dx = \int \frac{x\sin\left(c+dx\right)}{a+bx^2}\,dx$$

input
```
integrate(x*sin(d*x+c)/(b*x**2+a),x)
```

output
```
Integral(x*sin(c + d*x)/(a + b*x**2), x)
```

### 3.60.7 Maxima [F]

$$\int \frac{x\sin(c+dx)}{a+bx^2}\,dx = \int \frac{x\sin\left(dx+c\right)}{bx^2+a}\,dx$$

input
```
integrate(x*sin(d*x+c)/(b*x^2+a),x, algorithm="maxima")
```

output
```
-1/2*((cos(c)^2 + sin(c)^2)*x*cos(d*x + c) + (x*cos(d*x + c)^2*cos(c) + x*
cos(c)*sin(d*x + c)^2)*cos(d*x + 2*c) + 2*(((b*cos(c)^2 + b*sin(c)^2)*d*x^
2 + (a*cos(c)^2 + a*sin(c)^2)*d)*cos(d*x + c)^2 + ((b*cos(c)^2 + b*sin(c)^
2)*d*x^2 + (a*cos(c)^2 + a*sin(c)^2)*d)*sin(d*x + c)^2)*integrate(1/2*(b*x
^2 - a)*cos(d*x + c)/(b^2*d*x^4 + 2*a*b*d*x^2 + a^2*d), x) + 2*(((b*cos(c)
^2 + b*sin(c)^2)*d*x^2 + (a*cos(c)^2 + a*sin(c)^2)*d)*cos(d*x + c)^2 + ((b
*cos(c)^2 + b*sin(c)^2)*d*x^2 + (a*cos(c)^2 + a*sin(c)^2)*d)*sin(d*x + c)^
2)*integrate(1/2*(b*x^2 - a)*cos(d*x + c)/((b^2*d*x^4 + 2*a*b*d*x^2 + a^2*
d)*cos(d*x + c)^2 + (b^2*d*x^4 + 2*a*b*d*x^2 + a^2*d)*sin(d*x + c)^2), x)
+ (x*cos(d*x + c)^2*sin(c) + x*sin(d*x + c)^2*sin(c))*sin(d*x + 2*c))/(((b
*cos(c)^2 + b*sin(c)^2)*d*x^2 + (a*cos(c)^2 + a*sin(c)^2)*d)*cos(d*x + c)^
2 + ((b*cos(c)^2 + b*sin(c)^2)*d*x^2 + (a*cos(c)^2 + a*sin(c)^2)*d)*sin(d*
x + c)^2)
```

### 3.60.8 Giac [F]

$$\int \frac{x\sin(c+dx)}{a+bx^2}\,dx = \int \frac{x\sin\left(dx+c\right)}{bx^2+a}\,dx$$

input
```
integrate(x*sin(d*x+c)/(b*x^2+a),x, algorithm="giac")
```

output
```
integrate(x*sin(d*x + c)/(b*x^2 + a), x)
```

### 3.60.9 Mupad [F(-1)]

Timed out.

$$\int \frac{x\sin(c+dx)}{a+bx^2}\,dx = \int \frac{x\,\sin\left(c+d\,x\right)}{b\,x^2+a}\,dx$$

input
```
int((x*sin(c + d*x))/(a + b*x^2),x)
```

output
```
int((x*sin(c + d*x))/(a + b*x^2), x)
```

# 3.61 $\int \frac{\sin(c+dx)}{a+bx^2} dx$



## 3.61.1 Optimal result

Integrand size = 16, antiderivative size = 213

$$\int \frac{\sin(c+dx)}{a+bx^2} dx = -\frac{\text{CosIntegral}\left(\frac{\sqrt{-a}d}{\sqrt{b}}+dx\right)\sin\left(c-\frac{\sqrt{-a}d}{\sqrt{b}}\right)}{2\sqrt{-a}\sqrt{b}} + \frac{\text{CosIntegral}\left(\frac{\sqrt{-a}d}{\sqrt{b}}-dx\right)\sin\left(c+\frac{\sqrt{-a}d}{\sqrt{b}}\right)}{2\sqrt{-a}\sqrt{b}} - \frac{\cos\left(c+\frac{\sqrt{-a}d}{\sqrt{b}}\right)\text{Si}\left(\frac{\sqrt{-a}d}{\sqrt{b}}-dx\right)}{2\sqrt{-a}\sqrt{b}} - \frac{\cos\left(c-\frac{\sqrt{-a}d}{\sqrt{b}}\right)\text{Si}\left(\frac{\sqrt{-a}d}{\sqrt{b}}+dx\right)}{2\sqrt{-a}\sqrt{b}}$$

output
```
1/2*cos(c+d*(-a)^(1/2)/b^(1/2))*Si(d*x-d*(-a)^(1/2)/b^(1/2))/(-a)^(1/2)/b^
(1/2)-1/2*cos(c-d*(-a)^(1/2)/b^(1/2))*Si(d*x+d*(-a)^(1/2)/b^(1/2))/(-a)^(1
/2)/b^(1/2)-1/2*Ci(d*x+d*(-a)^(1/2)/b^(1/2))*sin(c-d*(-a)^(1/2)/b^(1/2))/(
-a)^(1/2)/b^(1/2)+1/2*Ci(-d*x+d*(-a)^(1/2)/b^(1/2))*sin(c+d*(-a)^(1/2)/b^(
1/2))/(-a)^(1/2)/b^(1/2)
```

### 3.61.2 Mathematica [C] (verified)

Result contains complex when optimal does not.

Time = 0.40 (sec) , antiderivative size = 163, normalized size of antiderivative = 0.77

$$\int \frac{\sin(c+dx)}{a+bx^2}\,dx = \frac{e^{-ic-\frac{\sqrt{a}d}{\sqrt{b}}}\left(e^{\frac{2\sqrt{a}d}{\sqrt{b}}}\,\text{ExpIntegralEi}\left(-\frac{\sqrt{a}d}{\sqrt{b}}-idx\right)-\text{ExpIntegralEi}\left(\frac{\sqrt{a}d}{\sqrt{b}}-idx\right)+e^{2ic}\left(e^{\frac{2\sqrt{a}d}{\sqrt{b}}}\,\text{ExpIntegralEi}\left(\right.\right.\right.}{4\sqrt{a}\sqrt{b}}$$

input
```
Integrate[Sin[c + d*x]/(a + b*x^2),x]
```

output
```
(E^((-I)*c - (Sqrt[a]*d)/Sqrt[b])*(E^((2*Sqrt[a]*d)/Sqrt[b])*ExpIntegralEi
[-((Sqrt[a]*d)/Sqrt[b]) - I*d*x] - ExpIntegralEi[(Sqrt[a]*d)/Sqrt[b] - I*d
*x] + E^((2*I)*c)*(E^((2*Sqrt[a]*d)/Sqrt[b])*ExpIntegralEi[-((Sqrt[a]*d)/S
qrt[b]) + I*d*x] - ExpIntegralEi[(Sqrt[a]*d)/Sqrt[b] + I*d*x])))/(4*Sqrt[a
]*Sqrt[b])
```

### 3.61.3 Rubi [A] (verified)

Time = 0.44 (sec) , antiderivative size = 213, normalized size of antiderivative = 1.00, number of steps used = 2, number of rules used = 2, $\frac{\text{number of rules}}{\text{integrand size}}$ = 0.125, Rules used = {3814, 2009}

Below are the steps used by Rubi to obtain the solution. The rule number used for the transformation is given above next to the arrow. The rules definitions used are listed below.

$$\int \frac{\sin(c+dx)}{a+bx^2}\,dx$$

$$\Big\downarrow \text{3814}$$

$$\int \left(\frac{\sqrt{-a}\sin(c+dx)}{2a\left(\sqrt{-a}-\sqrt{b}x\right)}+\frac{\sqrt{-a}\sin(c+dx)}{2a\left(\sqrt{-a}+\sqrt{b}x\right)}\right)dx$$

$$\Big\downarrow \text{2009}$$

$$-\frac{\sin\left(c-\frac{\sqrt{-a}d}{\sqrt{b}}\right)\text{CosIntegral}\left(xd+\frac{\sqrt{-a}d}{\sqrt{b}}\right)}{2\sqrt{-a}\sqrt{b}}+\frac{\sin\left(\frac{\sqrt{-a}d}{\sqrt{b}}+c\right)\text{CosIntegral}\left(\frac{\sqrt{-a}d}{\sqrt{b}}-dx\right)}{2\sqrt{-a}\sqrt{b}}-\frac{\cos\left(\frac{\sqrt{-a}d}{\sqrt{b}}+c\right)\text{Si}\left(\frac{\sqrt{-a}d}{\sqrt{b}}-dx\right)}{2\sqrt{-a}\sqrt{b}}-\frac{\cos\left(c-\frac{\sqrt{-a}d}{\sqrt{b}}\right)\text{Si}\left(xd+\frac{\sqrt{-a}d}{\sqrt{b}}\right)}{2\sqrt{-a}\sqrt{b}}$$

input
```
Int[Sin[c + d*x]/(a + b*x^2),x]
```

output
```
-1/2*(CosIntegral[(Sqrt[-a]*d)/Sqrt[b] + d*x]*Sin[c - (Sqrt[-a]*d)/Sqrt[b]
])/(Sqrt[-a]*Sqrt[b]) + (CosIntegral[(Sqrt[-a]*d)/Sqrt[b] - d*x]*Sin[c + (
Sqrt[-a]*d)/Sqrt[b]])/(2*Sqrt[-a]*Sqrt[b]) - (Cos[c + (Sqrt[-a]*d)/Sqrt[b]
]*SinIntegral[(Sqrt[-a]*d)/Sqrt[b] - d*x])/(2*Sqrt[-a]*Sqrt[b]) - (Cos[c -
 (Sqrt[-a]*d)/Sqrt[b]]*SinIntegral[(Sqrt[-a]*d)/Sqrt[b] + d*x])/(2*Sqrt[-a
]*Sqrt[b])
```

### 3.61.3.1 Defintions of rubi rules used

rule 2009
```
Int[u_, x_Symbol] :> Simp[IntSum[u, x], x] /; SumQ[u]
```

rule 3814
```
Int[((a_) + (b_.)*(x_)^(n_))^(p_)*Sin[(c_.) + (d_.)*(x_)], x_Symbol] :> Int
[ExpandIntegrand[Sin[c + d*x], (a + b*x^n)^p, x], x] /; FreeQ[{a, b, c, d},
 x] && ILtQ[p, 0] && IGtQ[n, 0] && (EqQ[n, 2] || EqQ[p, -1])
```

## 3.61.4 Maple [A] (verified)

Time = 0.26 (sec) , antiderivative size = 225, normalized size of antiderivative = 1.06

| method | result |
|---|---|
| derivativedivides | $d\left(-\frac{\text{Si}\left(dx+c-\frac{d\sqrt{-ab}+cb}{b}\right)\cos\left(\frac{d\sqrt{-ab}+cb}{b}\right)+\text{Ci}\left(dx+c-\frac{d\sqrt{-ab}+cb}{b}\right)\sin\left(\frac{d\sqrt{-ab}+cb}{b}\right)}{2b\left(-\frac{d\sqrt{-ab}+cb}{b}+c\right)}-\frac{\text{Si}\left(dx+c+\frac{d\sqrt{-ab}-cb}{b}\right)\cos\left(\right.}{}\right.$ |
| default | $d\left(-\frac{\text{Si}\left(dx+c-\frac{d\sqrt{-ab}+cb}{b}\right)\cos\left(\frac{d\sqrt{-ab}+cb}{b}\right)+\text{Ci}\left(dx+c-\frac{d\sqrt{-ab}+cb}{b}\right)\sin\left(\frac{d\sqrt{-ab}+cb}{b}\right)}{2b\left(-\frac{d\sqrt{-ab}+cb}{b}+c\right)}-\frac{\text{Si}\left(dx+c+\frac{d\sqrt{-ab}-cb}{b}\right)\cos\left(\right.}{}\right.$ |
| risch | $\frac{\sqrt{ab}\,\mathrm{e}^{-\frac{icb+d\sqrt{ab}}{b}}\,\text{Ei}_1\left(-\frac{icb+d\sqrt{ab}-b(idx+ic)}{b}\right)}{4ab}-\frac{\sqrt{ab}\,\mathrm{e}^{-\frac{icb-d\sqrt{ab}}{b}}\,\text{Ei}_1\left(-\frac{icb-d\sqrt{ab}-b(idx+ic)}{b}\right)}{4ab}-\frac{\sqrt{ab}\,\mathrm{e}^{\frac{icb+d\sqrt{ab}}{b}}\,\text{Ei}_1}{}$ |

input
```
int(sin(d*x+c)/(b*x^2+a),x,method=_RETURNVERBOSE)
```

output
```
d*(-1/2/b/(-(d*(-a*b)^(1/2)+c*b)/b+c)*(Si(d*x+c-(d*(-a*b)^(1/2)+c*b)/b)*co
s((d*(-a*b)^(1/2)+c*b)/b)+Ci(d*x+c-(d*(-a*b)^(1/2)+c*b)/b)*sin((d*(-a*b)^(
1/2)+c*b)/b))-1/2/b/((d*(-a*b)^(1/2)-c*b)/b+c)*(Si(d*x+c+(d*(-a*b)^(1/2)-c
*b)/b)*cos((d*(-a*b)^(1/2)-c*b)/b)-Ci(d*x+c+(d*(-a*b)^(1/2)-c*b)/b)*sin((d
*(-a*b)^(1/2)-c*b)/b)))
```

### 3.61.5 Fricas [C] (verification not implemented)

Result contains complex when optimal does not.

Time = 0.30 (sec) , antiderivative size = 187, normalized size of antiderivative = 0.88

$$\int \frac{\sin(c+dx)}{a+bx^2}\,dx = \frac{\sqrt{\frac{ad^2}{b}}\operatorname{Ei}\left(i\,dx-\sqrt{\frac{ad^2}{b}}\right)e^{\left(i\,c+\sqrt{\frac{ad^2}{b}}\right)}-\sqrt{\frac{ad^2}{b}}\operatorname{Ei}\left(i\,dx+\sqrt{\frac{ad^2}{b}}\right)e^{\left(i\,c-\sqrt{\frac{ad^2}{b}}\right)}+\sqrt{\frac{ad^2}{b}}\operatorname{Ei}\left(-i\,dx-\sqrt{\frac{ad^2}{b}}\right)e^{\left(-\right.}}{4\,ad}$$

input
```
integrate(sin(d*x+c)/(b*x^2+a),x, algorithm="fricas")
```

output
```
1/4*(sqrt(a*d^2/b)*Ei(I*d*x - sqrt(a*d^2/b))*e^(I*c + sqrt(a*d^2/b)) - sqr
t(a*d^2/b)*Ei(I*d*x + sqrt(a*d^2/b))*e^(I*c - sqrt(a*d^2/b)) + sqrt(a*d^2/
b)*Ei(-I*d*x - sqrt(a*d^2/b))*e^(-I*c + sqrt(a*d^2/b)) - sqrt(a*d^2/b)*Ei(
-I*d*x + sqrt(a*d^2/b))*e^(-I*c - sqrt(a*d^2/b)))/(a*d)
```

### 3.61.6 Sympy [F]

$$\int \frac{\sin(c+dx)}{a+bx^2}\,dx = \int \frac{\sin{(c+dx)}}{a+bx^2}\,dx$$

input
```
integrate(sin(d*x+c)/(b*x**2+a),x)
```

output
```
Integral(sin(c + d*x)/(a + b*x**2), x)
```

### 3.61.7 Maxima [F]

$$\int \frac{\sin(c+dx)}{a+bx^2}\,dx = \int \frac{\sin(dx+c)}{bx^2+a}\,dx$$

input
```
integrate(sin(d*x+c)/(b*x^2+a),x, algorithm="maxima")
```

output
```
integrate(sin(d*x + c)/(b*x^2 + a), x)
```

### 3.61.8 Giac [F]

$$\int \frac{\sin(c+dx)}{a+bx^2}\,dx = \int \frac{\sin(dx+c)}{bx^2+a}\,dx$$

input
```
integrate(sin(d*x+c)/(b*x^2+a),x, algorithm="giac")
```

output
```
integrate(sin(d*x + c)/(b*x^2 + a), x)
```

### 3.61.9 Mupad [F(-1)]

Timed out.

$$\int \frac{\sin(c+dx)}{a+bx^2}\,dx = \int \frac{\sin(c+d\,x)}{b\,x^2+a}\,dx$$

input
```
int(sin(c + d*x)/(a + b*x^2),x)
```

output
```
int(sin(c + d*x)/(a + b*x^2), x)
```

# 3.62 $\int \frac{\sin(c+dx)}{x(a+bx^2)}\,dx$



## 3.62.1 Optimal result

Integrand size = 19, antiderivative size = 197

$$\int \frac{\sin(c+dx)}{x(a+bx^2)}\,dx = \frac{\text{CosIntegral}(dx)\sin(c)}{a} - \frac{\text{CosIntegral}\left(\frac{\sqrt{-ad}}{\sqrt{b}}+dx\right)\sin\left(c-\frac{\sqrt{-ad}}{\sqrt{b}}\right)}{2a} - \frac{\text{CosIntegral}\left(\frac{\sqrt{-ad}}{\sqrt{b}}-dx\right)\sin\left(c+\frac{\sqrt{-ad}}{\sqrt{b}}\right)}{2a} + \frac{\cos(c)\text{Si}(dx)}{a} + \frac{\cos\left(c+\frac{\sqrt{-ad}}{\sqrt{b}}\right)\text{Si}\left(\frac{\sqrt{-ad}}{\sqrt{b}}-dx\right)}{2a} - \frac{\cos\left(c-\frac{\sqrt{-ad}}{\sqrt{b}}\right)\text{Si}\left(\frac{\sqrt{-ad}}{\sqrt{b}}+dx\right)}{2a}$$

output
```
cos(c)*Si(d*x)/a-1/2*cos(c+d*(-a)^(1/2)/b^(1/2))*Si(d*x-d*(-a)^(1/2)/b^(1/
2))/a-1/2*cos(c-d*(-a)^(1/2)/b^(1/2))*Si(d*x+d*(-a)^(1/2)/b^(1/2))/a+Ci(d*
x)*sin(c)/a-1/2*Ci(d*x+d*(-a)^(1/2)/b^(1/2))*sin(c-d*(-a)^(1/2)/b^(1/2))/a
-1/2*Ci(-d*x+d*(-a)^(1/2)/b^(1/2))*sin(c+d*(-a)^(1/2)/b^(1/2))/a
```

## 3.62.2 Mathematica [C] (verified)

Result contains complex when optimal does not.

Time = 0.36 (sec) , antiderivative size = 174, normalized size of antiderivative = 0.88

$$\int \frac{\sin(c+dx)}{x(a+bx^2)}\,dx = \frac{-ie^{-ic-\frac{\sqrt{ad}}{\sqrt{b}}}\left(e^{\frac{2\sqrt{ad}}{\sqrt{b}}}\text{ExpIntegralEi}\left(-\frac{\sqrt{ad}}{\sqrt{b}}-idx\right)+\text{ExpIntegralEi}\left(\frac{\sqrt{ad}}{\sqrt{b}}-idx\right)-e^{2ic}\left(e^{\frac{2\sqrt{ad}}{\sqrt{b}}}\text{ExpIntegralE}\right.\right.}{4a}$$

input
```
Integrate[Sin[c + d*x]/(x*(a + b*x^2)),x]
```

output
```
((-I)*E^((-I)*c - (Sqrt[a]*d)/Sqrt[b])*(E^((2*Sqrt[a]*d)/Sqrt[b])*ExpInteg
ralEi[-((Sqrt[a]*d)/Sqrt[b]) - I*d*x] + ExpIntegralEi[(Sqrt[a]*d)/Sqrt[b]
- I*d*x] - E^((2*I)*c)*(E^((2*Sqrt[a]*d)/Sqrt[b])*ExpIntegralEi[-((Sqrt[a]
*d)/Sqrt[b]) + I*d*x] + ExpIntegralEi[(Sqrt[a]*d)/Sqrt[b] + I*d*x])) + 4*C
osIntegral[d*x]*Sin[c] + 4*Cos[c]*SinIntegral[d*x])/(4*a)
```

### 3.62.3 Rubi [A] (verified)

Time = 0.55 (sec) , antiderivative size = 197, normalized size of antiderivative = 1.00, number of steps used = 2, number of rules used = 2, $\frac{\text{number of rules}}{\text{integrand size}}$ = 0.105, Rules used = {3826, 2009}

Below are the steps used by Rubi to obtain the solution. The rule number used for the transformation is given above next to the arrow. The rules definitions used are listed below.

$$\int \frac{\sin(c+dx)}{x(a+bx^2)}\,dx$$

$$\Big\downarrow \text{3826}$$

$$\int \left(\frac{\sin(c+dx)}{ax}-\frac{bx\sin(c+dx)}{a(a+bx^2)}\right)dx$$

$$\Big\downarrow \text{2009}$$

$$-\frac{\sin\left(c-\frac{\sqrt{-a}d}{\sqrt{b}}\right)\text{CosIntegral}\left(xd+\frac{\sqrt{-a}d}{\sqrt{b}}\right)}{2a}-\frac{\sin\left(\frac{\sqrt{-a}d}{\sqrt{b}}+c\right)\text{CosIntegral}\left(\frac{\sqrt{-a}d}{\sqrt{b}}-dx\right)}{2a}+\frac{\cos\left(\frac{\sqrt{-a}d}{\sqrt{b}}+c\right)\text{Si}\left(\frac{\sqrt{-a}d}{\sqrt{b}}-dx\right)}{2a}-\frac{\cos\left(c-\frac{\sqrt{-a}d}{\sqrt{b}}\right)\text{Si}\left(xd+\frac{\sqrt{-a}d}{\sqrt{b}}\right)}{2a}+\frac{\sin(c)\text{CosIntegral}(dx)}{a}+\frac{\cos(c)\text{Si}(dx)}{a}$$

input
```
Int[Sin[c + d*x]/(x*(a + b*x^2)),x]
```

output
```
(CosIntegral[d*x]*Sin[c])/a - (CosIntegral[(Sqrt[-a]*d)/Sqrt[b] + d*x]*Sin
[c - (Sqrt[-a]*d)/Sqrt[b]])/(2*a) - (CosIntegral[(Sqrt[-a]*d)/Sqrt[b] - d*
x]*Sin[c + (Sqrt[-a]*d)/Sqrt[b]])/(2*a) + (Cos[c]*SinIntegral[d*x])/a + (C
os[c + (Sqrt[-a]*d)/Sqrt[b]]*SinIntegral[(Sqrt[-a]*d)/Sqrt[b] - d*x])/(2*a
) - (Cos[c - (Sqrt[-a]*d)/Sqrt[b]]*SinIntegral[(Sqrt[-a]*d)/Sqrt[b] + d*x]
)/(2*a)
```

#### 3.62.3.1 Defintions of rubi rules used

rule 2009
```
Int[u_, x_Symbol] :> Simp[IntSum[u, x], x] /; SumQ[u]
```

rule 3826
```
Int[(x_)^(m_.)*((a_) + (b_.)*(x_)^(n_))^(p_)*Sin[(c_.) + (d_.)*(x_)], x_Sym
bol] :> Int[ExpandIntegrand[Sin[c + d*x], x^m*(a + b*x^n)^p, x], x] /; Free
Q[{a, b, c, d, m}, x] && ILtQ[p, 0] && IGtQ[n, 0] && (EqQ[n, 2] || EqQ[p, -
1]) && IntegerQ[m]
```

### 3.62.4 Maple [A] (verified)

Time = 0.27 (sec) , antiderivative size = 200, normalized size of antiderivative = 1.02

| method | result |
|---|---|
| derivativedivides | $-\frac{\mathrm{Si}\left(dx+c-\frac{d\sqrt{-ab}+cb}{b}\right)\cos\left(\frac{d\sqrt{-ab}+cb}{b}\right)+\mathrm{Ci}\left(dx+c-\frac{d\sqrt{-ab}+cb}{b}\right)\sin\left(\frac{d\sqrt{-ab}+cb}{b}\right)}{2a}-\frac{\mathrm{Si}\left(dx+c+\frac{d\sqrt{-ab}-cb}{b}\right)\cos\left(\frac{d\sqrt{-}}{}\right.}{}$ |
| default | $-\frac{\mathrm{Si}\left(dx+c-\frac{d\sqrt{-ab}+cb}{b}\right)\cos\left(\frac{d\sqrt{-ab}+cb}{b}\right)+\mathrm{Ci}\left(dx+c-\frac{d\sqrt{-ab}+cb}{b}\right)\sin\left(\frac{d\sqrt{-ab}+cb}{b}\right)}{2a}-\frac{\mathrm{Si}\left(dx+c+\frac{d\sqrt{-ab}-cb}{b}\right)\cos\left(\frac{d\sqrt{-}}{}\right.}{}$ |
| risch | $-\frac{i e^{\frac{icb+d\sqrt{ab}}{b}}\mathrm{Ei}_1\left(\frac{icb+d\sqrt{ab}-b(idx+ic)}{b}\right)}{4a}-\frac{i e^{\frac{icb-d\sqrt{ab}}{b}}\mathrm{Ei}_1\left(\frac{icb-d\sqrt{ab}-b(idx+ic)}{b}\right)}{4a}+\frac{i e^{ic}\,\mathrm{Ei}_1(-idx)}{2a}+\frac{i e^{-\frac{icb+d\sqrt{a}}{b}}}{}$ |

input
```
int(sin(d*x+c)/x/(b*x^2+a),x,method=_RETURNVERBOSE)
```

output
```
-1/2/a*(Si(d*x+c-(d*(-a*b)^(1/2)+c*b)/b)*cos((d*(-a*b)^(1/2)+c*b)/b)+Ci(d*
x+c-(d*(-a*b)^(1/2)+c*b)/b)*sin((d*(-a*b)^(1/2)+c*b)/b))-1/2/a*(Si(d*x+c+(
d*(-a*b)^(1/2)-c*b)/b)*cos((d*(-a*b)^(1/2)-c*b)/b)-Ci(d*x+c+(d*(-a*b)^(1/2
)-c*b)/b)*sin((d*(-a*b)^(1/2)-c*b)/b))+1/a*(Si(d*x)*cos(c)+Ci(d*x)*sin(c))
```

### 3.62.5 Fricas [C] (verification not implemented)

Result contains complex when optimal does not.

Time = 0.30 (sec) , antiderivative size = 162, normalized size of antiderivative = 0.82

$$\int \frac{\sin(c+dx)}{x\,(a+bx^2)}\,dx = \frac{i\,\mathrm{Ei}\left(i\,dx-\sqrt{\frac{ad^2}{b}}\right)e^{\left(i\,c+\sqrt{\frac{ad^2}{b}}\right)}+i\,\mathrm{Ei}\left(i\,dx+\sqrt{\frac{ad^2}{b}}\right)e^{\left(i\,c-\sqrt{\frac{ad^2}{b}}\right)}-i\,\mathrm{Ei}\left(-i\,dx-\sqrt{\frac{ad^2}{b}}\right)e^{\left(-i\,c+\sqrt{\frac{ad^2}{b}}\right)}-}{4\,a}$$

input
```
integrate(sin(d*x+c)/x/(b*x^2+a),x, algorithm="fricas")
```

output
```
1/4*(I*Ei(I*d*x - sqrt(a*d^2/b))*e^(I*c + sqrt(a*d^2/b)) + I*Ei(I*d*x + sq
rt(a*d^2/b))*e^(I*c - sqrt(a*d^2/b)) - I*Ei(-I*d*x - sqrt(a*d^2/b))*e^(-I*
c + sqrt(a*d^2/b)) - I*Ei(-I*d*x + sqrt(a*d^2/b))*e^(-I*c - sqrt(a*d^2/b))
 + 4*cos_integral(d*x)*sin(c) + 4*cos(c)*sin_integral(d*x))/a
```

### 3.62.6 Sympy [F]

$$\int \frac{\sin(c+dx)}{x(a+bx^2)}\,dx = \int \frac{\sin(c+dx)}{x(a+bx^2)}\,dx$$

input
```
integrate(sin(d*x+c)/x/(b*x**2+a),x)
```

output
```
Integral(sin(c + d*x)/(x*(a + b*x**2)), x)
```

### 3.62.7 Maxima [F]

$$\int \frac{\sin(c+dx)}{x(a+bx^2)}\,dx = \int \frac{\sin(dx+c)}{(bx^2+a)x}\,dx$$

input
```
integrate(sin(d*x+c)/x/(b*x^2+a),x, algorithm="maxima")
```

output
```
integrate(sin(d*x + c)/((b*x^2 + a)*x), x)
```

### 3.62.8 Giac [F]

$$\int \frac{\sin(c+dx)}{x(a+bx^2)}\,dx = \int \frac{\sin(dx+c)}{(bx^2+a)x}\,dx$$

input
```
integrate(sin(d*x+c)/x/(b*x^2+a),x, algorithm="giac")
```

output
```
integrate(sin(d*x + c)/((b*x^2 + a)*x), x)
```

### 3.62.9 Mupad [F(-1)]

Timed out.

$$\int \frac{\sin(c+dx)}{x\,(a+bx^2)}\,dx = \int \frac{\sin\left(c+d\,x\right)}{x\,\left(b\,x^2+a\right)}\,dx$$

input
```
int(sin(c + d*x)/(x*(a + b*x^2)),x)
```

output
```
int(sin(c + d*x)/(x*(a + b*x^2)), x)
```

# 3.63 $\int \frac{\sin(c+dx)}{x^2(a+bx^2)}\,dx$



## 3.63.1 Optimal result

Integrand size = 19, antiderivative size = 250

$$\int \frac{\sin(c+dx)}{x^2(a+bx^2)}\,dx = \frac{d\cos(c)\operatorname{CosIntegral}(dx)}{a} - \frac{\sqrt{b}\operatorname{CosIntegral}\left(\frac{\sqrt{-a}d}{\sqrt{b}}+dx\right)\sin\left(c-\frac{\sqrt{-a}d}{\sqrt{b}}\right)}{2(-a)^{3/2}} + \frac{\sqrt{b}\operatorname{CosIntegral}\left(\frac{\sqrt{-a}d}{\sqrt{b}}-dx\right)\sin\left(c+\frac{\sqrt{-a}d}{\sqrt{b}}\right)}{2(-a)^{3/2}} - \frac{\sin(c+dx)}{ax} - \frac{d\sin(c)\operatorname{Si}(dx)}{a} - \frac{\sqrt{b}\cos\left(c+\frac{\sqrt{-a}d}{\sqrt{b}}\right)\operatorname{Si}\left(\frac{\sqrt{-a}d}{\sqrt{b}}-dx\right)}{2(-a)^{3/2}} - \frac{\sqrt{b}\cos\left(c-\frac{\sqrt{-a}d}{\sqrt{b}}\right)\operatorname{Si}\left(\frac{\sqrt{-a}d}{\sqrt{b}}+dx\right)}{2(-a)^{3/2}}$$

output
```
d*Ci(d*x)*cos(c)/a-d*Si(d*x)*sin(c)/a-sin(d*x+c)/a/x+1/2*cos(c+d*(-a)^(1/2
)/b^(1/2))*Si(d*x-d*(-a)^(1/2)/b^(1/2))*b^(1/2)/(-a)^(3/2)-1/2*cos(c-d*(-a
)^(1/2)/b^(1/2))*Si(d*x+d*(-a)^(1/2)/b^(1/2))*b^(1/2)/(-a)^(3/2)-1/2*Ci(d*
x+d*(-a)^(1/2)/b^(1/2))*sin(c-d*(-a)^(1/2)/b^(1/2))*b^(1/2)/(-a)^(3/2)+1/2
*Ci(-d*x+d*(-a)^(1/2)/b^(1/2))*sin(c+d*(-a)^(1/2)/b^(1/2))*b^(1/2)/(-a)^(3
/2)
```

### 3.63.2 Mathematica [C] (verified)

Result contains complex when optimal does not.

Time = 0.57 (sec) , antiderivative size = 238, normalized size of antiderivative = 0.95

$$\int \frac{\sin(c+dx)}{x^2(a+bx^2)}\,dx = \frac{\sqrt{b}e^{-ic-\frac{\sqrt{a}d}{\sqrt{b}}}\left(-e^{\frac{2\sqrt{a}d}{\sqrt{b}}}\text{ExpIntegralEi}\left(-\frac{\sqrt{a}d}{\sqrt{b}}-idx\right)+\text{ExpIntegralEi}\left(\frac{\sqrt{a}d}{\sqrt{b}}-idx\right)\right)}{4a^{3/2}} + \frac{\sqrt{b}e^{ic-\frac{\sqrt{a}d}{\sqrt{b}}}\left(-e^{\frac{2\sqrt{a}d}{\sqrt{b}}}\text{ExpIntegralEi}\left(-\frac{\sqrt{a}d}{\sqrt{b}}+idx\right)+\text{ExpIntegralEi}\left(\frac{\sqrt{a}d}{\sqrt{b}}+idx\right)\right)}{4a^{3/2}} - \frac{\cos(dx)\sin(c)}{ax} - \frac{\cos(c)\sin(dx)}{ax} + \frac{d(\cos(c)\,\text{CosIntegral}(dx)-\sin(c)\text{Si}(dx))}{a}$$

input
```
Integrate[Sin[c + d*x]/(x^2*(a + b*x^2)),x]
```

output
```
(Sqrt[b]*E^((-I)*c - (Sqrt[a]*d)/Sqrt[b])*(-(E^((2*Sqrt[a]*d)/Sqrt[b])*Exp
IntegralEi[-((Sqrt[a]*d)/Sqrt[b]) - I*d*x]) + ExpIntegralEi[(Sqrt[a]*d)/Sq
rt[b] - I*d*x]))/(4*a^(3/2)) + (Sqrt[b]*E^(I*c - (Sqrt[a]*d)/Sqrt[b])*(-(E
^((2*Sqrt[a]*d)/Sqrt[b])*ExpIntegralEi[-((Sqrt[a]*d)/Sqrt[b]) + I*d*x]) +
ExpIntegralEi[(Sqrt[a]*d)/Sqrt[b] + I*d*x]))/(4*a^(3/2)) - (Cos[d*x]*Sin[c
])/(a*x) - (Cos[c]*Sin[d*x])/(a*x) + (d*(Cos[c]*CosIntegral[d*x] - Sin[c]*
SinIntegral[d*x]))/a
```

### 3.63.3 Rubi [A] (verified)

Time = 0.62 (sec) , antiderivative size = 250, normalized size of antiderivative = 1.00, number of steps used = 2, number of rules used = 2, $\frac{\text{number of rules}}{\text{integrand size}}$ = 0.105, Rules used = {3826, 2009}

Below are the steps used by Rubi to obtain the solution. The rule number used for the transformation is given above next to the arrow. The rules definitions used are listed below.

$$\int \frac{\sin(c+dx)}{x^2(a+bx^2)}\,dx$$

$$\Big\downarrow \text{3826}$$

$$\int \left(\frac{\sin(c+dx)}{ax^2}-\frac{b\sin(c+dx)}{a(a+bx^2)}\right)dx$$

$$\Big\downarrow \text{2009}$$

$$-\frac{\sqrt{b}\sin\left(c-\frac{\sqrt{-a}d}{\sqrt{b}}\right)\text{CosIntegral}\left(xd+\frac{\sqrt{-a}d}{\sqrt{b}}\right)}{2(-a)^{3/2}}+\frac{\sqrt{b}\sin\left(\frac{\sqrt{-a}d}{\sqrt{b}}+c\right)\text{CosIntegral}\left(\frac{\sqrt{-a}d}{\sqrt{b}}-dx\right)}{2(-a)^{3/2}}-\frac{\sqrt{b}\cos\left(\frac{\sqrt{-a}d}{\sqrt{b}}+c\right)\text{Si}\left(\frac{\sqrt{-a}d}{\sqrt{b}}-dx\right)}{2(-a)^{3/2}}-\frac{\sqrt{b}\cos\left(c-\frac{\sqrt{-a}d}{\sqrt{b}}\right)\text{Si}\left(xd+\frac{\sqrt{-a}d}{\sqrt{b}}\right)}{2(-a)^{3/2}}+\frac{d\cos(c)\text{CosIntegral}(dx)}{a}-\frac{d\sin(c)\text{Si}(dx)}{a}-\frac{\sin(c+dx)}{ax}$$

input
```
Int[Sin[c + d*x]/(x^2*(a + b*x^2)),x]
```

output
```
(d*Cos[c]*CosIntegral[d*x])/a - (Sqrt[b]*CosIntegral[(Sqrt[-a]*d)/Sqrt[b]
+ d*x]*Sin[c - (Sqrt[-a]*d)/Sqrt[b]])/(2*(-a)^(3/2)) + (Sqrt[b]*CosIntegra
l[(Sqrt[-a]*d)/Sqrt[b] - d*x]*Sin[c + (Sqrt[-a]*d)/Sqrt[b]])/(2*(-a)^(3/2)
) - Sin[c + d*x]/(a*x) - (d*Sin[c]*SinIntegral[d*x])/a - (Sqrt[b]*Cos[c +
(Sqrt[-a]*d)/Sqrt[b]]*SinIntegral[(Sqrt[-a]*d)/Sqrt[b] - d*x])/(2*(-a)^(3/
2)) - (Sqrt[b]*Cos[c - (Sqrt[-a]*d)/Sqrt[b]]*SinIntegral[(Sqrt[-a]*d)/Sqrt
[b] + d*x])/(2*(-a)^(3/2))
```

### 3.63.3.1 Defintions of rubi rules used

rule 2009
```
Int[u_, x_Symbol] :> Simp[IntSum[u, x], x] /; SumQ[u]
```

rule 3826
```
Int[(x_)^(m_.)*((a_) + (b_.)*(x_)^(n_))^(p_)*Sin[(c_.) + (d_.)*(x_)], x_Sym
bol] :> Int[ExpandIntegrand[Sin[c + d*x], x^m*(a + b*x^n)^p, x], x] /; Free
Q[{a, b, c, d, m}, x] && ILtQ[p, 0] && IGtQ[n, 0] && (EqQ[n, 2] || EqQ[p, -
1]) && IntegerQ[m]
```

### 3.63.4 Maple [A] (verified)

Time = 0.33 (sec) , antiderivative size = 266, normalized size of antiderivative = 1.06

| method | result |
|---|---|
| derivativedivides | $d\left(-\frac{b\left(-\frac{\operatorname{Si}\left(dx+c-\frac{d\sqrt{-ab}+cb}{b}\right)\cos\left(\frac{d\sqrt{-ab}+cb}{b}\right)+\operatorname{Ci}\left(dx+c-\frac{d\sqrt{-ab}+cb}{b}\right)\sin\left(\frac{d\sqrt{-ab}+cb}{b}\right)}{2b\left(-\frac{d\sqrt{-ab}+cb}{b}+c\right)}-\frac{\operatorname{Si}\left(dx+c+\frac{d\sqrt{-ab}-cb}{b}\right)\cos\left(\frac{d}{}\right.}{}\right.}{a}\right.$ |
| default | $d\left(-\frac{b\left(-\frac{\operatorname{Si}\left(dx+c-\frac{d\sqrt{-ab}+cb}{b}\right)\cos\left(\frac{d\sqrt{-ab}+cb}{b}\right)+\operatorname{Ci}\left(dx+c-\frac{d\sqrt{-ab}+cb}{b}\right)\sin\left(\frac{d\sqrt{-ab}+cb}{b}\right)}{2b\left(-\frac{d\sqrt{-ab}+cb}{b}+c\right)}-\frac{\operatorname{Si}\left(dx+c+\frac{d\sqrt{-ab}-cb}{b}\right)\cos\left(\frac{d}{}\right.}{}\right.}{a}\right.$ |
| risch | $-\frac{d\operatorname{Ei}_1(-idx)e^{ic}}{2a}+\frac{\sqrt{ab}\,e^{\frac{icb+d\sqrt{ab}}{b}}\operatorname{Ei}_1\left(\frac{icb+d\sqrt{ab}-b(idx+ic)}{b}\right)}{4a^2}-\frac{\sqrt{ab}\,e^{\frac{icb-d\sqrt{ab}}{b}}\operatorname{Ei}_1\left(-\frac{-icb+d\sqrt{ab}+b(idx+ic)}{b}\right)}{4a^2}-$ |

input
```
int(sin(d*x+c)/x^2/(b*x^2+a),x,method=_RETURNVERBOSE)
```

output
```
d*(-b/a*(-1/2/b/(-(d*(-a*b)^(1/2)+c*b)/b+c)*(Si(d*x+c-(d*(-a*b)^(1/2)+c*b)
/b)*cos((d*(-a*b)^(1/2)+c*b)/b)+Ci(d*x+c-(d*(-a*b)^(1/2)+c*b)/b)*sin((d*(-
a*b)^(1/2)+c*b)/b))-1/2/b/((d*(-a*b)^(1/2)-c*b)/b+c)*(Si(d*x+c+(d*(-a*b)^(
1/2)-c*b)/b)*cos((d*(-a*b)^(1/2)-c*b)/b)-Ci(d*x+c+(d*(-a*b)^(1/2)-c*b)/b)*
sin((d*(-a*b)^(1/2)-c*b)/b)))+1/a*(-sin(d*x+c)/d/x-Si(d*x)*sin(c)+Ci(d*x)*
cos(c)))
```

### 3.63.5 Fricas [C] (verification not implemented)

Result contains complex when optimal does not.

Time = 0.34 (sec) , antiderivative size = 234, normalized size of antiderivative = 0.94

$$\int \frac{\sin(c+dx)}{x^2(a+bx^2)}\,dx$$

$$=\frac{4\,ad^2x\cos(c)\operatorname{Ci}(dx)-4\,ad^2x\sin(c)\operatorname{Si}(dx)-\sqrt{\frac{ad^2}{b}}bx\operatorname{Ei}\left(i\,dx-\sqrt{\frac{ad^2}{b}}\right)e^{\left(i\,c+\sqrt{\frac{ad^2}{b}}\right)}+\sqrt{\frac{ad^2}{b}}bx\operatorname{Ei}\left(i\,dx+\right.}{}$$

input
```
integrate(sin(d*x+c)/x^2/(b*x^2+a),x, algorithm="fricas")
```

output
```
1/4*(4*a*d^2*x*cos(c)*cos_integral(d*x) - 4*a*d^2*x*sin(c)*sin_integral(d*
x) - sqrt(a*d^2/b)*b*x*Ei(I*d*x - sqrt(a*d^2/b))*e^(I*c + sqrt(a*d^2/b)) +
 sqrt(a*d^2/b)*b*x*Ei(I*d*x + sqrt(a*d^2/b))*e^(I*c - sqrt(a*d^2/b)) - sqr
t(a*d^2/b)*b*x*Ei(-I*d*x - sqrt(a*d^2/b))*e^(-I*c + sqrt(a*d^2/b)) + sqrt(
a*d^2/b)*b*x*Ei(-I*d*x + sqrt(a*d^2/b))*e^(-I*c - sqrt(a*d^2/b)) - 4*a*d*s
in(d*x + c))/(a^2*d*x)
```

### 3.63.6 Sympy [F]

$$\int \frac{\sin(c+dx)}{x^2(a+bx^2)}\,dx = \int \frac{\sin(c+dx)}{x^2(a+bx^2)}\,dx$$

input
```
integrate(sin(d*x+c)/x**2/(b*x**2+a),x)
```

output
```
Integral(sin(c + d*x)/(x**2*(a + b*x**2)), x)
```

### 3.63.7 Maxima [F]

$$\int \frac{\sin(c+dx)}{x^2(a+bx^2)}\,dx = \int \frac{\sin(dx+c)}{(bx^2+a)x^2}\,dx$$

input
```
integrate(sin(d*x+c)/x^2/(b*x^2+a),x, algorithm="maxima")
```

output
```
integrate(sin(d*x + c)/((b*x^2 + a)*x^2), x)
```

### 3.63.8 Giac [F]

$$\int \frac{\sin(c+dx)}{x^2(a+bx^2)}\,dx = \int \frac{\sin(dx+c)}{(bx^2+a)x^2}\,dx$$

input
```
integrate(sin(d*x+c)/x^2/(b*x^2+a),x, algorithm="giac")
```

output
```
integrate(sin(d*x + c)/((b*x^2 + a)*x^2), x)
```

### 3.63.9 Mupad [F(-1)]

Timed out.

$$\int \frac{\sin(c+dx)}{x^2(a+bx^2)}\,dx=\int \frac{\sin\left(c+d\,x\right)}{x^2\,\left(b\,x^2+a\right)}\,dx$$

input
```
int(sin(c + d*x)/(x^2*(a + b*x^2)),x)
```

output
```
int(sin(c + d*x)/(x^2*(a + b*x^2)), x)
```

# 3.64 $\int \frac{\sin(c+dx)}{x^3(a+bx^2)}\,dx$



## 3.64.1 Optimal result

Integrand size = 19, antiderivative size = 270

$$\begin{aligned}\int \frac{\sin(c+dx)}{x^3(a+bx^2)}\,dx = & -\frac{d\cos(c+dx)}{2ax}-\frac{b\,\text{CosIntegral}(dx)\sin(c)}{a^2}-\frac{d^2\,\text{CosIntegral}(dx)\sin(c)}{2a}\\ & +\frac{b\,\text{CosIntegral}\left(\frac{\sqrt{-a}d}{\sqrt{b}}+dx\right)\sin\left(c-\frac{\sqrt{-a}d}{\sqrt{b}}\right)}{2a^2}\\ & +\frac{b\,\text{CosIntegral}\left(\frac{\sqrt{-a}d}{\sqrt{b}}-dx\right)\sin\left(c+\frac{\sqrt{-a}d}{\sqrt{b}}\right)}{2a^2}\\ & -\frac{\sin(c+dx)}{2ax^2}-\frac{b\cos(c)\text{Si}(dx)}{a^2}-\frac{d^2\cos(c)\text{Si}(dx)}{2a}\\ & -\frac{b\cos\left(c+\frac{\sqrt{-a}d}{\sqrt{b}}\right)\text{Si}\left(\frac{\sqrt{-a}d}{\sqrt{b}}-dx\right)}{2a^2}+\frac{b\cos\left(c-\frac{\sqrt{-a}d}{\sqrt{b}}\right)\text{Si}\left(\frac{\sqrt{-a}d}{\sqrt{b}}+dx\right)}{2a^2}\end{aligned}$$

output
```
-1/2*d*cos(d*x+c)/a/x-b*cos(c)*Si(d*x)/a^2-1/2*d^2*cos(c)*Si(d*x)/a+1/2*b*
cos(c+d*(-a)^(1/2)/b^(1/2))*Si(d*x-d*(-a)^(1/2)/b^(1/2))/a^2+1/2*b*cos(c-d
*(-a)^(1/2)/b^(1/2))*Si(d*x+d*(-a)^(1/2)/b^(1/2))/a^2-b*Ci(d*x)*sin(c)/a^2
-1/2*d^2*Ci(d*x)*sin(c)/a-1/2*sin(d*x+c)/a/x^2+1/2*b*Ci(d*x+d*(-a)^(1/2)/b
^(1/2))*sin(c-d*(-a)^(1/2)/b^(1/2))/a^2+1/2*b*Ci(-d*x+d*(-a)^(1/2)/b^(1/2)
)*sin(c+d*(-a)^(1/2)/b^(1/2))/a^2
```

## 3.64.2 Mathematica [C] (verified)

Result contains complex when optimal does not.

Time = 0.83 (sec) , antiderivative size = 240, normalized size of antiderivative = 0.89

$$\int \frac{\sin(c+dx)}{x^3(a+bx^2)}\,dx = \frac{ibe^{-ic-\frac{\sqrt{a}d}{\sqrt{b}}}\left(e^{\frac{2\sqrt{a}d}{\sqrt{b}}}\text{ExpIntegralEi}\left(-\frac{\sqrt{a}d}{\sqrt{b}}-idx\right)+\text{ExpIntegralEi}\left(\frac{\sqrt{a}d}{\sqrt{b}}-idx\right)\right)-ibe^{ic-\frac{\sqrt{a}d}{\sqrt{b}}}\left(e^{\frac{2\sqrt{a}d}{\sqrt{b}}}\text{ExpInt}\right.}{}$$

input
```
Integrate[Sin[c + d*x]/(x^3*(a + b*x^2)),x]
```

output
```
(I*b*E^((-I)*c - (Sqrt[a]*d)/Sqrt[b])*(E^((2*Sqrt[a]*d)/Sqrt[b])*ExpIntegr
alEi[-((Sqrt[a]*d)/Sqrt[b]) - I*d*x] + ExpIntegralEi[(Sqrt[a]*d)/Sqrt[b] -
 I*d*x]) - I*b*E^(I*c - (Sqrt[a]*d)/Sqrt[b])*(E^((2*Sqrt[a]*d)/Sqrt[b])*Ex
pIntegralEi[-((Sqrt[a]*d)/Sqrt[b]) + I*d*x] + ExpIntegralEi[(Sqrt[a]*d)/Sq
rt[b] + I*d*x]) - (2*a*Cos[d*x]*(d*x*Cos[c] + Sin[c]))/x^2 + (2*a*(-Cos[c]
 + d*x*Sin[c])*Sin[d*x])/x^2 - 2*(2*b + a*d^2)*(CosIntegral[d*x]*Sin[c] +
Cos[c]*SinIntegral[d*x]))/(4*a^2)
```

## 3.64.3 Rubi [A] (verified)

Time = 0.66 (sec) , antiderivative size = 270, normalized size of antiderivative = 1.00, number of steps used = 2, number of rules used = 2, $\frac{\text{number of rules}}{\text{integrand size}} = 0.105$, Rules used = {3826, 2009}

Below are the steps used by Rubi to obtain the solution. The rule number used for the transformation is given above next to the arrow. The rules definitions used are listed below.

$$\int \frac{\sin(c+dx)}{x^3(a+bx^2)}\,dx$$

$$\Big\downarrow \text{ 3826}$$

$$\int \left(\frac{b^2x\sin(c+dx)}{a^2(a+bx^2)}-\frac{b\sin(c+dx)}{a^2x}+\frac{\sin(c+dx)}{ax^3}\right)dx$$

$$\Big\downarrow \text{ 2009}$$

$$-\frac{b\sin(c)\operatorname{CosIntegral}(dx)}{a^2}+\frac{b\sin\left(c-\frac{\sqrt{-a}d}{\sqrt{b}}\right)\operatorname{CosIntegral}\left(xd+\frac{\sqrt{-a}d}{\sqrt{b}}\right)}{2a^2}+\frac{b\sin\left(\frac{\sqrt{-a}d}{\sqrt{b}}+c\right)\operatorname{CosIntegral}\left(\frac{\sqrt{-a}d}{\sqrt{b}}-dx\right)}{2a^2}-\frac{b\cos(c)\operatorname{Si}(dx)}{a^2}-\frac{b\cos\left(\frac{\sqrt{-a}d}{\sqrt{b}}+c\right)\operatorname{Si}\left(\frac{\sqrt{-a}d}{\sqrt{b}}-dx\right)}{2a^2}+\frac{b\cos\left(c-\frac{\sqrt{-a}d}{\sqrt{b}}\right)\operatorname{Si}\left(xd+\frac{\sqrt{-a}d}{\sqrt{b}}\right)}{2a^2}-\frac{d^2\sin(c)\operatorname{CosIntegral}(dx)}{2a}-\frac{d^2\cos(c)\operatorname{Si}(dx)}{2a}-\frac{\sin(c+dx)}{2ax^2}-\frac{d\cos(c+dx)}{2ax}$$

input
```
Int[Sin[c + d*x]/(x^3*(a + b*x^2)),x]
```

output
```
-1/2*(d*Cos[c + d*x])/(a*x) - (b*CosIntegral[d*x]*Sin[c])/a^2 - (d^2*CosIn
tegral[d*x]*Sin[c])/(2*a) + (b*CosIntegral[(Sqrt[-a]*d)/Sqrt[b] + d*x]*Sin
[c - (Sqrt[-a]*d)/Sqrt[b]])/(2*a^2) + (b*CosIntegral[(Sqrt[-a]*d)/Sqrt[b]
- d*x]*Sin[c + (Sqrt[-a]*d)/Sqrt[b]])/(2*a^2) - Sin[c + d*x]/(2*a*x^2) - (
b*Cos[c]*SinIntegral[d*x])/a^2 - (d^2*Cos[c]*SinIntegral[d*x])/(2*a) - (b*
Cos[c + (Sqrt[-a]*d)/Sqrt[b]]*SinIntegral[(Sqrt[-a]*d)/Sqrt[b] - d*x])/(2*
a^2) + (b*Cos[c - (Sqrt[-a]*d)/Sqrt[b]]*SinIntegral[(Sqrt[-a]*d)/Sqrt[b] +
 d*x])/(2*a^2)
```

#### 3.64.3.1 Defintions of rubi rules used

rule 2009
```
Int[u_, x_Symbol] :> Simp[IntSum[u, x], x] /; SumQ[u]
```

rule 3826
```
Int[(x_)^(m_.)*((a_) + (b_.)*(x_)^(n_))^(p_)*Sin[(c_.) + (d_.)*(x_)], x_Sym
bol] :> Int[ExpandIntegrand[Sin[c + d*x], x^m*(a + b*x^n)^p, x], x] /; Free
Q[{a, b, c, d, m}, x] && ILtQ[p, 0] && IGtQ[n, 0] && (EqQ[n, 2] || EqQ[p, -
1]) && IntegerQ[m]
```

### 3.64.4 Maple [A] (verified)

Time = 0.38 (sec) , antiderivative size = 259, normalized size of antiderivative = 0.96

| method | result |
|---|---|
| derivativedivides | $d^{2}\left(-\frac{\sin(dx+c)}{2a\,d^{2}x^{2}}-\frac{\cos(dx+c)}{2adx}+\frac{b\left(\mathrm{Si}\left(dx+c-\frac{d\sqrt{-ab}+cb}{b}\right)\cos\left(\frac{d\sqrt{-ab}+cb}{b}\right)+\mathrm{Ci}\left(dx+c-\frac{d\sqrt{-ab}+cb}{b}\right)\sin\left(\frac{d\sqrt{-ab}+cb}{b}\right.\right.}{2a^{2}d^{2}}\right.$ |
| default | $d^{2}\left(-\frac{\sin(dx+c)}{2a\,d^{2}x^{2}}-\frac{\cos(dx+c)}{2adx}+\frac{b\left(\mathrm{Si}\left(dx+c-\frac{d\sqrt{-ab}+cb}{b}\right)\cos\left(\frac{d\sqrt{-ab}+cb}{b}\right)+\mathrm{Ci}\left(dx+c-\frac{d\sqrt{-ab}+cb}{b}\right)\sin\left(\frac{d\sqrt{-ab}+cb}{b}\right.\right.}{2a^{2}d^{2}}\right.$ |
| risch | $\frac{ib\,\mathrm{e}^{\frac{icb+d\sqrt{ab}}{b}}\,\mathrm{Ei}_{1}\left(\frac{icb+d\sqrt{ab}-b(idx+ic)}{b}\right)}{4a^{2}}+\frac{ib\,\mathrm{e}^{\frac{icb-d\sqrt{ab}}{b}}\,\mathrm{Ei}_{1}\left(\frac{icb-d\sqrt{ab}-b(idx+ic)}{b}\right)}{4a^{2}}-\frac{id^{2}\mathrm{e}^{ic}\,\mathrm{Ei}_{1}(-idx)}{4a}-\frac{i\mathrm{e}^{ic}\,\mathrm{Ei}_{1}(-}{2a^{2}}$ |

input
```
int(sin(d*x+c)/x^3/(b*x^2+a),x,method=_RETURNVERBOSE)
```

output
```
d^2*(-1/2*sin(d*x+c)/a/d^2/x^2-1/2*cos(d*x+c)/a/d/x+1/2*b/a^2/d^2*(Si(d*x+
c-(d*(-a*b)^(1/2)+c*b)/b)*cos((d*(-a*b)^(1/2)+c*b)/b)+Ci(d*x+c-(d*(-a*b)^(
1/2)+c*b)/b)*sin((d*(-a*b)^(1/2)+c*b)/b))+1/2*b/a^2/d^2*(Si(d*x+c+(d*(-a*b
)^(1/2)-c*b)/b)*cos((d*(-a*b)^(1/2)-c*b)/b)-Ci(d*x+c+(d*(-a*b)^(1/2)-c*b)/
b)*sin((d*(-a*b)^(1/2)-c*b)/b))-1/2/a^2*(a*d^2+2*b)/d^2*(Si(d*x)*cos(c)+Ci
(d*x)*sin(c)))
```

### 3.64.5 Fricas [C] (verification not implemented)

Result contains complex when optimal does not.

Time = 0.30 (sec) , antiderivative size = 225, normalized size of antiderivative = 0.83

$$\int \frac{\sin(c+dx)}{x^{3}\left(a+bx^{2}\right)}\,dx$$
$$=\frac{-i\,bx^{2}\mathrm{Ei}\left(i\,dx-\sqrt{\frac{ad^{2}}{b}}\right)e^{\left(i\,c+\sqrt{\frac{ad^{2}}{b}}\right)}-i\,bx^{2}\mathrm{Ei}\left(i\,dx+\sqrt{\frac{ad^{2}}{b}}\right)e^{\left(i\,c-\sqrt{\frac{ad^{2}}{b}}\right)}+i\,bx^{2}\mathrm{Ei}\left(-i\,dx-\sqrt{\frac{ad^{2}}{b}}\right)e^{\left(-i\right.}}{}$$

input
```
integrate(sin(d*x+c)/x^3/(b*x^2+a),x, algorithm="fricas")
```

output
```
1/4*(-I*b*x^2*Ei(I*d*x - sqrt(a*d^2/b))*e^(I*c + sqrt(a*d^2/b)) - I*b*x^2*
Ei(I*d*x + sqrt(a*d^2/b))*e^(I*c - sqrt(a*d^2/b)) + I*b*x^2*Ei(-I*d*x - sq
rt(a*d^2/b))*e^(-I*c + sqrt(a*d^2/b)) + I*b*x^2*Ei(-I*d*x + sqrt(a*d^2/b))
*e^(-I*c - sqrt(a*d^2/b)) - 2*(a*d^2 + 2*b)*x^2*cos_integral(d*x)*sin(c) -
 2*(a*d^2 + 2*b)*x^2*cos(c)*sin_integral(d*x) - 2*a*d*x*cos(d*x + c) - 2*a
*sin(d*x + c))/(a^2*x^2)
```

### 3.64.6 Sympy [F]

$$\int \frac{\sin(c+dx)}{x^3\,(a+bx^2)}\,dx = \int \frac{\sin{(c+dx)}}{x^3\,(a+bx^2)}\,dx$$

input
```
integrate(sin(d*x+c)/x**3/(b*x**2+a),x)
```

output
```
Integral(sin(c + d*x)/(x**3*(a + b*x**2)), x)
```

### 3.64.7 Maxima [F]

$$\int \frac{\sin(c+dx)}{x^3\,(a+bx^2)}\,dx = \int \frac{\sin{(dx+c)}}{(bx^2+a)x^3}\,dx$$

input
```
integrate(sin(d*x+c)/x^3/(b*x^2+a),x, algorithm="maxima")
```

output
```
integrate(sin(d*x + c)/((b*x^2 + a)*x^3), x)
```

### 3.64.8 Giac [F]

$$\int \frac{\sin(c+dx)}{x^3\,(a+bx^2)}\,dx = \int \frac{\sin{(dx+c)}}{(bx^2+a)x^3}\,dx$$

input
```
integrate(sin(d*x+c)/x^3/(b*x^2+a),x, algorithm="giac")
```

output
```
integrate(sin(d*x + c)/((b*x^2 + a)*x^3), x)
```

### 3.64.9 Mupad [F(-1)]

Timed out.

$$\int \frac{\sin(c+dx)}{x^3(a+bx^2)}\,dx = \int \frac{\sin\left(c+d\,x\right)}{x^3\,\left(b\,x^2+a\right)}\,dx$$

input
```
int(sin(c + d*x)/(x^3*(a + b*x^2)),x)
```

output
```
int(sin(c + d*x)/(x^3*(a + b*x^2)), x)
```

# 3.65 $\int \frac{x^4 \sin(c+dx)}{(a+bx^2)^2} dx$



## 3.65.1 Optimal result

Integrand size = 19, antiderivative size = 450

$$\int \frac{x^4 \sin(c+dx)}{(a+bx^2)^2} dx = -\frac{\cos(c+dx)}{b^2 d} - \frac{ad \cos\left(c+\frac{\sqrt{-ad}}{\sqrt{b}}\right) \text{CosIntegral}\left(\frac{\sqrt{-ad}}{\sqrt{b}}-dx\right)}{4b^3} - \frac{ad \cos\left(c-\frac{\sqrt{-ad}}{\sqrt{b}}\right) \text{CosIntegral}\left(\frac{\sqrt{-ad}}{\sqrt{b}}+dx\right)}{4b^3} - \frac{3\sqrt{-a}\,\text{CosIntegral}\left(\frac{\sqrt{-ad}}{\sqrt{b}}+dx\right) \sin\left(c-\frac{\sqrt{-ad}}{\sqrt{b}}\right)}{4b^{5/2}} + \frac{3\sqrt{-a}\,\text{CosIntegral}\left(\frac{\sqrt{-ad}}{\sqrt{b}}-dx\right) \sin\left(c+\frac{\sqrt{-ad}}{\sqrt{b}}\right)}{4b^{5/2}} + \frac{x\sin(c+dx)}{2b^2} - \frac{x^3 \sin(c+dx)}{2b(a+bx^2)} - \frac{3\sqrt{-a}\cos\left(c+\frac{\sqrt{-ad}}{\sqrt{b}}\right) \text{Si}\left(\frac{\sqrt{-ad}}{\sqrt{b}}-dx\right)}{4b^{5/2}} - \frac{ad \sin\left(c+\frac{\sqrt{-ad}}{\sqrt{b}}\right) \text{Si}\left(\frac{\sqrt{-ad}}{\sqrt{b}}-dx\right)}{4b^3} - \frac{3\sqrt{-a}\cos\left(c-\frac{\sqrt{-ad}}{\sqrt{b}}\right) \text{Si}\left(\frac{\sqrt{-ad}}{\sqrt{b}}+dx\right)}{4b^{5/2}} + \frac{ad \sin\left(c-\frac{\sqrt{-ad}}{\sqrt{b}}\right) \text{Si}\left(\frac{\sqrt{-ad}}{\sqrt{b}}+dx\right)}{4b^3}$$

output
```
-cos(d*x+c)/b^2/d-1/4*a*d*Ci(d*x+d*(-a)^(1/2)/b^(1/2))*cos(c-d*(-a)^(1/2)/
b^(1/2))/b^3-1/4*a*d*Ci(-d*x+d*(-a)^(1/2)/b^(1/2))*cos(c+d*(-a)^(1/2)/b^(1
/2))/b^3+1/2*x*sin(d*x+c)/b^2-1/2*x^3*sin(d*x+c)/b/(b*x^2+a)+1/4*a*d*Si(d*
x+d*(-a)^(1/2)/b^(1/2))*sin(c-d*(-a)^(1/2)/b^(1/2))/b^3+1/4*a*d*Si(d*x-d*(
-a)^(1/2)/b^(1/2))*sin(c+d*(-a)^(1/2)/b^(1/2))/b^3+3/4*cos(c+d*(-a)^(1/2)/
b^(1/2))*Si(d*x-d*(-a)^(1/2)/b^(1/2))*(-a)^(1/2)/b^(5/2)-3/4*cos(c-d*(-a)^
(1/2)/b^(1/2))*Si(d*x+d*(-a)^(1/2)/b^(1/2))*(-a)^(1/2)/b^(5/2)-3/4*Ci(d*x+
d*(-a)^(1/2)/b^(1/2))*sin(c-d*(-a)^(1/2)/b^(1/2))*(-a)^(1/2)/b^(5/2)+3/4*C
i(-d*x+d*(-a)^(1/2)/b^(1/2))*sin(c+d*(-a)^(1/2)/b^(1/2))*(-a)^(1/2)/b^(5/2
)
```

### 3.65.2 Mathematica [C] (verified)

Result contains complex when optimal does not.

Time = 3.15 (sec) , antiderivative size = 298, normalized size of antiderivative = 0.66

$$\int \frac{x^4 \sin(c+dx)}{(a+bx^2)^2} \, dx =$$
$$-\frac{\sqrt{a}e^{-ic-\frac{\sqrt{a}d}{\sqrt{b}}}\left(\left(3\sqrt{b}+\sqrt{a}d\right)e^{\frac{2\sqrt{a}d}{\sqrt{b}}}\text{ExpIntegralEi}\left(-\frac{\sqrt{a}d}{\sqrt{b}}-idx\right)+\left(-3\sqrt{b}+\sqrt{a}d\right)\text{ExpIntegralEi}\left(\frac{\sqrt{a}d}{\sqrt{b}}\right.}{}$$

input
```
Integrate[(x^4*Sin[c + d*x])/(a + b*x^2)^2,x]
```

output
```
-1/8*(Sqrt[a]*E^((-I)*c - (Sqrt[a]*d)/Sqrt[b])*((3*Sqrt[b] + Sqrt[a]*d)*E^
((2*Sqrt[a]*d)/Sqrt[b])*ExpIntegralEi[-((Sqrt[a]*d)/Sqrt[b]) - I*d*x] + (-
3*Sqrt[b] + Sqrt[a]*d)*ExpIntegralEi[(Sqrt[a]*d)/Sqrt[b] - I*d*x]) + Sqrt[
a]*E^(I*c - (Sqrt[a]*d)/Sqrt[b])*((3*Sqrt[b] + Sqrt[a]*d)*E^((2*Sqrt[a]*d)
/Sqrt[b])*ExpIntegralEi[-((Sqrt[a]*d)/Sqrt[b]) + I*d*x] + (-3*Sqrt[b] + Sq
rt[a]*d)*ExpIntegralEi[(Sqrt[a]*d)/Sqrt[b] + I*d*x]) - 4*b*Cos[d*x]*((-2*C
os[c])/d + (a*x*Sin[c])/(a + b*x^2)) - 4*b*((a*x*Cos[c])/(a + b*x^2) + (2*
Sin[c])/d)*Sin[d*x])/b^3
```

### 3.65.3 Rubi [A] (verified)

Time = 1.17 (sec) , antiderivative size = 476, normalized size of antiderivative = 1.06, number of steps used = 5, number of rules used = 5, $\frac{\text{number of rules}}{\text{integrand size}}$ = 0.263, Rules used = {3824, 3826, 2009, 3827, 2009}

Below are the steps used by Rubi to obtain the solution. The rule number used for the transformation is given above next to the arrow. The rules definitions used are listed below.

$$\int \frac{x^4\sin(c+dx)}{(a+bx^2)^2}dx$$

$$\Big\downarrow \text{3824}$$

$$\frac{3\int \frac{x^2\sin(c+dx)}{bx^2+a}dx}{2b}+\frac{d\int \frac{x^3\cos(c+dx)}{bx^2+a}dx}{2b}-\frac{x^3\sin(c+dx)}{2b(a+bx^2)}$$

$$\Big\downarrow \text{3826}$$

$$\frac{3\int \left(\frac{\sin(c+dx)}{b}-\frac{a\sin(c+dx)}{b(bx^2+a)}\right)dx}{2b}+\frac{d\int \frac{x^3\cos(c+dx)}{bx^2+a}dx}{2b}-\frac{x^3\sin(c+dx)}{2b(a+bx^2)}$$

$$\Big\downarrow \text{2009}$$

$$\frac{d\int \frac{x^3\cos(c+dx)}{bx^2+a}dx}{2b}+$$

$$\frac{3\left(-\frac{\sqrt{-a}\sin\left(c-\frac{\sqrt{-a}d}{\sqrt{b}}\right)\text{CosIntegral}\left(xd+\frac{\sqrt{-a}d}{\sqrt{b}}\right)}{2b^{3/2}}+\frac{\sqrt{-a}\sin\left(\frac{\sqrt{-a}d}{\sqrt{b}}+c\right)\text{CosIntegral}\left(\frac{\sqrt{-a}d}{\sqrt{b}}-dx\right)}{2b^{3/2}}-\frac{\sqrt{-a}\cos\left(\frac{\sqrt{-a}d}{\sqrt{b}}+c\right)\text{Si}\left(\frac{\sqrt{-a}d}{\sqrt{b}}-dx\right)}{2b^{3/2}}-\right.}{2b}$$

$$\frac{x^3\sin(c+dx)}{2b(a+bx^2)}$$

$$\Big\downarrow \text{3827}$$

$$\frac{d\int \left(\frac{x\cos(c+dx)}{b}-\frac{ax\cos(c+dx)}{b(bx^2+a)}\right)dx}{2b}+$$

$$\frac{3\left(-\frac{\sqrt{-a}\sin\left(c-\frac{\sqrt{-a}d}{\sqrt{b}}\right)\text{CosIntegral}\left(xd+\frac{\sqrt{-a}d}{\sqrt{b}}\right)}{2b^{3/2}}+\frac{\sqrt{-a}\sin\left(\frac{\sqrt{-a}d}{\sqrt{b}}+c\right)\text{CosIntegral}\left(\frac{\sqrt{-a}d}{\sqrt{b}}-dx\right)}{2b^{3/2}}-\frac{\sqrt{-a}\cos\left(\frac{\sqrt{-a}d}{\sqrt{b}}+c\right)\text{Si}\left(\frac{\sqrt{-a}d}{\sqrt{b}}-dx\right)}{2b^{3/2}}-\right.}{2b}$$

$$\frac{x^3\sin(c+dx)}{2b(a+bx^2)}$$

$$\Big\downarrow \text{2009}$$

$$\frac{3\left(-\frac{\sqrt{-a}\sin\left(c-\frac{\sqrt{-a}d}{\sqrt{b}}\right)\text{CosIntegral}\left(xd+\frac{\sqrt{-a}d}{\sqrt{b}}\right)}{2b^{3/2}}+\frac{\sqrt{-a}\sin\left(\frac{\sqrt{-a}d}{\sqrt{b}}+c\right)\text{CosIntegral}\left(\frac{\sqrt{-a}d}{\sqrt{b}}-dx\right)}{2b^{3/2}}-\frac{\sqrt{-a}\cos\left(\frac{\sqrt{-a}d}{\sqrt{b}}+c\right)\text{Si}\left(\frac{\sqrt{-a}d}{\sqrt{b}}-dx\right)}{2b^{3/2}}-\right.}{2b}$$

$$\frac{d\left(-\frac{a\cos\left(\frac{\sqrt{-a}d}{\sqrt{b}}+c\right)\text{CosIntegral}\left(\frac{\sqrt{-a}d}{\sqrt{b}}-dx\right)}{2b^2}-\frac{a\cos\left(c-\frac{\sqrt{-a}d}{\sqrt{b}}\right)\text{CosIntegral}\left(xd+\frac{\sqrt{-a}d}{\sqrt{b}}\right)}{2b^2}-\frac{a\sin\left(\frac{\sqrt{-a}d}{\sqrt{b}}+c\right)\text{Si}\left(\frac{\sqrt{-a}d}{\sqrt{b}}-dx\right)}{2b^2}+\frac{a\sin\left(c-\right.}{}\right.}{2b}$$

$$\frac{x^3\sin(c+dx)}{2b\left(a+bx^2\right)}$$

input
```
Int[(x^4*Sin[c + d*x])/(a + b*x^2)^2,x]
```

output
```
-1/2*(x^3*Sin[c + d*x])/(b*(a + b*x^2)) + (3*(-(Cos[c + d*x]/(b*d)) - (Sqr
t[-a]*CosIntegral[(Sqrt[-a]*d)/Sqrt[b] + d*x]*Sin[c - (Sqrt[-a]*d)/Sqrt[b]
])/(2*b^(3/2)) + (Sqrt[-a]*CosIntegral[(Sqrt[-a]*d)/Sqrt[b] - d*x]*Sin[c +
 (Sqrt[-a]*d)/Sqrt[b]])/(2*b^(3/2)) - (Sqrt[-a]*Cos[c + (Sqrt[-a]*d)/Sqrt[
b]]*SinIntegral[(Sqrt[-a]*d)/Sqrt[b] - d*x])/(2*b^(3/2)) - (Sqrt[-a]*Cos[c
 - (Sqrt[-a]*d)/Sqrt[b]]*SinIntegral[(Sqrt[-a]*d)/Sqrt[b] + d*x])/(2*b^(3/
2))))/(2*b) + (d*(Cos[c + d*x]/(b*d^2) - (a*Cos[c + (Sqrt[-a]*d)/Sqrt[b]]*
CosIntegral[(Sqrt[-a]*d)/Sqrt[b] - d*x])/(2*b^2) - (a*Cos[c - (Sqrt[-a]*d)
/Sqrt[b]]*CosIntegral[(Sqrt[-a]*d)/Sqrt[b] + d*x])/(2*b^2) + (x*Sin[c + d*
x])/(b*d) - (a*Sin[c + (Sqrt[-a]*d)/Sqrt[b]]*SinIntegral[(Sqrt[-a]*d)/Sqrt
[b] - d*x])/(2*b^2) + (a*Sin[c - (Sqrt[-a]*d)/Sqrt[b]]*SinIntegral[(Sqrt[-
a]*d)/Sqrt[b] + d*x])/(2*b^2)))/(2*b)
```

### 3.65.3.1 Defintions of rubi rules used

rule 2009
```
Int[u_, x_Symbol] :> Simp[IntSum[u, x], x] /; SumQ[u]
```

rule 3824
```
Int[(x_)^(m_.)*((a_) + (b_.)*(x_)^(n_))^(p_)*Sin[(c_.) + (d_.)*(x_)], x_Sym
bol] :> Simp[x^(m - n + 1)*(a + b*x^n)^(p + 1)*(Sin[c + d*x]/(b*n*(p + 1)))
, x] + (-Simp[(m - n + 1)/(b*n*(p + 1))   Int[x^(m - n)*(a + b*x^n)^(p + 1)
*Sin[c + d*x], x], x] - Simp[d/(b*n*(p + 1))   Int[x^(m - n + 1)*(a + b*x^n
)^(p + 1)*Cos[c + d*x], x], x]) /; FreeQ[{a, b, c, d, m}, x] && ILtQ[p, -1]
 && IGtQ[n, 0] && (GtQ[m - n + 1, 0] || GtQ[n, 2]) && RationalQ[m]
```

rule 3826
```
Int[(x_)^(m_.)*((a_) + (b_.)*(x_)^(n_))^(p_)*Sin[(c_.) + (d_.)*(x_)], x_Sym
bol] :> Int[ExpandIntegrand[Sin[c + d*x], x^m*(a + b*x^n)^p, x], x] /; Free
Q[{a, b, c, d, m}, x] && ILtQ[p, 0] && IGtQ[n, 0] && (EqQ[n, 2] || EqQ[p, -
1]) && IntegerQ[m]
```

rule 3827
```
Int[Cos[(c_.) + (d_.)*(x_)]*(x_)^(m_.)*((a_) + (b_.)*(x_)^(n_))^(p_), x_Sym
bol] :> Int[ExpandIntegrand[Cos[c + d*x], x^m*(a + b*x^n)^p, x], x] /; Free
Q[{a, b, c, d, m}, x] && ILtQ[p, 0] && IGtQ[n, 0] && (EqQ[n, 2] || EqQ[p, -
1]) && IntegerQ[m]
```

## 3.65.4 Maple [C] (verified)

Result contains complex when optimal does not.

Time = 0.78 (sec) , antiderivative size = 524, normalized size of antiderivative = 1.16

| method | result |
|---|---|
| risch | $\frac{\mathrm{e}^{\frac{icb+d\sqrt{ab}}{b}} \operatorname{Ei}_1\left(\frac{icb+d\sqrt{ab}-b(idx+ic)}{b}\right) ad}{8b^3} + \frac{\mathrm{e}^{\frac{icb-d\sqrt{ab}}{b}} \operatorname{Ei}_1\left(-\frac{-icb+d\sqrt{ab}+b(idx+ic)}{b}\right) ad}{8b^3} + \frac{3\sqrt{ab}\,\mathrm{e}^{\frac{icb+d\sqrt{ab}}{b}} \operatorname{Ei}_1\left(\frac{icb+c}{}\right.}{8b^3}$ |
| derivativedivides | Expression too large to display |
| default | Expression too large to display |

input
```
int(x^4*sin(d*x+c)/(b*x^2+a)^2,x,method=_RETURNVERBOSE)
```

output
```
1/8/b^3*exp((I*c*b+d*(a*b)^(1/2))/b)*Ei(1,(I*c*b+d*(a*b)^(1/2)-b*(I*d*x+I*
c))/b)*a*d+1/8/b^3*exp((I*c*b-d*(a*b)^(1/2))/b)*Ei(1,-(-I*c*b+d*(a*b)^(1/2
)+b*(I*d*x+I*c))/b)*a*d+3/8/b^3*(a*b)^(1/2)*exp((I*c*b+d*(a*b)^(1/2))/b)*E
i(1,(I*c*b+d*(a*b)^(1/2)-b*(I*d*x+I*c))/b)-3/8/b^3*(a*b)^(1/2)*exp((I*c*b-
d*(a*b)^(1/2))/b)*Ei(1,-(-I*c*b+d*(a*b)^(1/2)+b*(I*d*x+I*c))/b)+1/8/b^3*ex
p(-(I*c*b+d*(a*b)^(1/2))/b)*Ei(1,-(I*c*b+d*(a*b)^(1/2)-b*(I*d*x+I*c))/b)*a
*d+1/8/b^3*exp(-(I*c*b-d*(a*b)^(1/2))/b)*Ei(1,(-I*c*b+d*(a*b)^(1/2)+b*(I*d
*x+I*c))/b)*a*d-3/8/b^3*(a*b)^(1/2)*exp(-(I*c*b+d*(a*b)^(1/2))/b)*Ei(1,-(I
*c*b+d*(a*b)^(1/2)-b*(I*d*x+I*c))/b)+3/8/b^3*(a*b)^(1/2)*exp(-(I*c*b-d*(a*
b)^(1/2))/b)*Ei(1,(-I*c*b+d*(a*b)^(1/2)+b*(I*d*x+I*c))/b)-cos(d*x+c)/b^2/d
+1/2*d^2*a*x/b^2/(b*d^2*x^2+a*d^2)*sin(d*x+c)
```

### 3.65.5 Fricas [C] (verification not implemented)

Result contains complex when optimal does not.

Time = 0.32 (sec) , antiderivative size = 351, normalized size of antiderivative = 0.78

$$\int \frac{x^4 \sin(c+dx)}{(a+bx^2)^2} \, dx$$
$$= \frac{4\,abdx \sin{(dx+c)} - \left(abd^2x^2 + a^2d^2 + 3\,(b^2x^2+ab)\sqrt{\frac{ad^2}{b}}\right)\mathrm{Ei}\left(i\,dx - \sqrt{\frac{ad^2}{b}}\right)e^{\left(i\,c+\sqrt{\frac{ad^2}{b}}\right)} - \left(abd^2x^2 + a\right.}{}$$

input
```
integrate(x^4*sin(d*x+c)/(b*x^2+a)^2,x, algorithm="fricas")
```

output
```
1/8*(4*a*b*d*x*sin(d*x + c) - (a*b*d^2*x^2 + a^2*d^2 + 3*(b^2*x^2 + a*b)*s
qrt(a*d^2/b))*Ei(I*d*x - sqrt(a*d^2/b))*e^(I*c + sqrt(a*d^2/b)) - (a*b*d^2
*x^2 + a^2*d^2 - 3*(b^2*x^2 + a*b)*sqrt(a*d^2/b))*Ei(I*d*x + sqrt(a*d^2/b)
)*e^(I*c - sqrt(a*d^2/b)) - (a*b*d^2*x^2 + a^2*d^2 + 3*(b^2*x^2 + a*b)*sqr
t(a*d^2/b))*Ei(-I*d*x - sqrt(a*d^2/b))*e^(-I*c + sqrt(a*d^2/b)) - (a*b*d^2
*x^2 + a^2*d^2 - 3*(b^2*x^2 + a*b)*sqrt(a*d^2/b))*Ei(-I*d*x + sqrt(a*d^2/b
))*e^(-I*c - sqrt(a*d^2/b)) - 8*(b^2*x^2 + a*b)*cos(d*x + c))/(b^4*d*x^2 +
 a*b^3*d)
```

### 3.65.6 Sympy [F]

$$\int \frac{x^4 \sin(c+dx)}{(a+bx^2)^2} \, dx = \int \frac{x^4 \sin{(c+dx)}}{(a+bx^2)^2} \, dx$$

input
```
integrate(x**4*sin(d*x+c)/(b*x**2+a)**2,x)
```

output
```
Integral(x**4*sin(c + d*x)/(a + b*x**2)**2, x)
```

### 3.65.7 Maxima [F]

$$\int \frac{x^4 \sin(c+dx)}{(a+bx^2)^2} \, dx = \int \frac{x^4 \sin(dx+c)}{(bx^2+a)^2} \, dx$$

input
```
integrate(x^4*sin(d*x+c)/(b*x^2+a)^2,x, algorithm="maxima")
```

output
```
-1/2*((b*cos(c)^2 + b*sin(c)^2)*d*x^4*cos(d*x + c) - 4*(a*cos(c)^2 + a*sin
(c)^2)*x*sin(d*x + c) + ((b*d*x^4*cos(c) + 4*a*x*sin(c))*cos(d*x + c)^2 +
(b*d*x^4*cos(c) + 4*a*x*sin(c))*sin(d*x + c)^2)*cos(d*x + 2*c) - 2*(((b^3*
cos(c)^2 + b^3*sin(c)^2)*d^2*x^4 + 2*(a*b^2*cos(c)^2 + a*b^2*sin(c)^2)*d^2
*x^2 + (a^2*b*cos(c)^2 + a^2*b*sin(c)^2)*d^2)*cos(d*x + c)^2 + ((b^3*cos(c
)^2 + b^3*sin(c)^2)*d^2*x^4 + 2*(a*b^2*cos(c)^2 + a*b^2*sin(c)^2)*d^2*x^2
+ (a^2*b*cos(c)^2 + a^2*b*sin(c)^2)*d^2)*sin(d*x + c)^2)*integrate(-2*(a^2
*d*x*cos(d*x + c) - (3*a*b*x^2 - a^2)*sin(d*x + c))/(b^4*d^2*x^6 + 3*a*b^3
*d^2*x^4 + 3*a^2*b^2*d^2*x^2 + a^3*b*d^2), x) - 2*(((b^3*cos(c)^2 + b^3*si
n(c)^2)*d^2*x^4 + 2*(a*b^2*cos(c)^2 + a*b^2*sin(c)^2)*d^2*x^2 + (a^2*b*cos
(c)^2 + a^2*b*sin(c)^2)*d^2)*cos(d*x + c)^2 + ((b^3*cos(c)^2 + b^3*sin(c)^
2)*d^2*x^4 + 2*(a*b^2*cos(c)^2 + a*b^2*sin(c)^2)*d^2*x^2 + (a^2*b*cos(c)^2
 + a^2*b*sin(c)^2)*d^2)*sin(d*x + c)^2)*integrate(-2*(a^2*d*x*cos(d*x + c)
 - (3*a*b*x^2 - a^2)*sin(d*x + c))/((b^4*d^2*x^6 + 3*a*b^3*d^2*x^4 + 3*a^2
*b^2*d^2*x^2 + a^3*b*d^2)*cos(d*x + c)^2 + (b^4*d^2*x^6 + 3*a*b^3*d^2*x^4
+ 3*a^2*b^2*d^2*x^2 + a^3*b*d^2)*sin(d*x + c)^2), x) + ((b*d*x^4*sin(c) -
4*a*x*cos(c))*cos(d*x + c)^2 + (b*d*x^4*sin(c) - 4*a*x*cos(c))*sin(d*x + c
)^2)*sin(d*x + 2*c))/(((b^3*cos(c)^2 + b^3*sin(c)^2)*d^2*x^4 + 2*(a*b^2*co
s(c)^2 + a*b^2*sin(c)^2)*d^2*x^2 + (a^2*b*cos(c)^2 + a^2*b*sin(c)^2)*d^2)*
cos(d*x + c)^2 + ((b^3*cos(c)^2 + b^3*sin(c)^2)*d^2*x^4 + 2*(a*b^2*cos(...
```

### 3.65.8 Giac [F]

$$\int \frac{x^4 \sin(c+dx)}{(a+bx^2)^2} \, dx = \int \frac{x^4 \sin(dx+c)}{(bx^2+a)^2} \, dx$$

input
```
integrate(x^4*sin(d*x+c)/(b*x^2+a)^2,x, algorithm="giac")
```

output
```
integrate(x^4*sin(d*x + c)/(b*x^2 + a)^2, x)
```

### 3.65.9 Mupad [F(-1)]

Timed out.

$$\int \frac{x^4 \sin(c+dx)}{(a+bx^2)^2}\,dx = \int \frac{x^4\,\sin(c+d\,x)}{(b\,x^2+a)^2}\,dx$$

input
```
int((x^4*sin(c + d*x))/(a + b*x^2)^2,x)
```

output
```
int((x^4*sin(c + d*x))/(a + b*x^2)^2, x)
```

# 3.66 $\int \frac{x^3 \sin(c+dx)}{(a+bx^2)^2} dx$



## 3.66.1 Optimal result

Integrand size = 19, antiderivative size = 431

$$
\begin{aligned}
\int \frac{x^3 \sin(c+dx)}{(a+bx^2)^2} dx &= \frac{\sqrt{-a}d\cos\left(c+\frac{\sqrt{-a}d}{\sqrt{b}}\right)\text{CosIntegral}\left(\frac{\sqrt{-a}d}{\sqrt{b}}-dx\right)}{4b^{5/2}} \\
&- \frac{\sqrt{-a}d\cos\left(c-\frac{\sqrt{-a}d}{\sqrt{b}}\right)\text{CosIntegral}\left(\frac{\sqrt{-a}d}{\sqrt{b}}+dx\right)}{4b^{5/2}} \\
&+ \frac{\text{CosIntegral}\left(\frac{\sqrt{-a}d}{\sqrt{b}}+dx\right)\sin\left(c-\frac{\sqrt{-a}d}{\sqrt{b}}\right)}{2b^2} \\
&+ \frac{\text{CosIntegral}\left(\frac{\sqrt{-a}d}{\sqrt{b}}-dx\right)\sin\left(c+\frac{\sqrt{-a}d}{\sqrt{b}}\right)}{2b^2} + \frac{\sin(c+dx)}{2b^2} \\
&- \frac{x^2\sin(c+dx)}{2b(a+bx^2)} - \frac{\cos\left(c+\frac{\sqrt{-a}d}{\sqrt{b}}\right)\text{Si}\left(\frac{\sqrt{-a}d}{\sqrt{b}}-dx\right)}{2b^2} \\
&+ \frac{\sqrt{-a}d\sin\left(c+\frac{\sqrt{-a}d}{\sqrt{b}}\right)\text{Si}\left(\frac{\sqrt{-a}d}{\sqrt{b}}-dx\right)}{4b^{5/2}} \\
&+ \frac{\cos\left(c-\frac{\sqrt{-a}d}{\sqrt{b}}\right)\text{Si}\left(\frac{\sqrt{-a}d}{\sqrt{b}}+dx\right)}{2b^2} \\
&+ \frac{\sqrt{-a}d\sin\left(c-\frac{\sqrt{-a}d}{\sqrt{b}}\right)\text{Si}\left(\frac{\sqrt{-a}d}{\sqrt{b}}+dx\right)}{4b^{5/2}}
\end{aligned}
$$

output
```
1/2*cos(c+d*(-a)^(1/2)/b^(1/2))*Si(d*x-d*(-a)^(1/2)/b^(1/2))/b^2+1/2*cos(c
-d*(-a)^(1/2)/b^(1/2))*Si(d*x+d*(-a)^(1/2)/b^(1/2))/b^2+1/2*sin(d*x+c)/b^2
-1/2*x^2*sin(d*x+c)/b/(b*x^2+a)+1/2*Ci(d*x+d*(-a)^(1/2)/b^(1/2))*sin(c-d*(
-a)^(1/2)/b^(1/2))/b^2+1/2*Ci(-d*x+d*(-a)^(1/2)/b^(1/2))*sin(c+d*(-a)^(1/2
)/b^(1/2))/b^2-1/4*d*Ci(d*x+d*(-a)^(1/2)/b^(1/2))*cos(c-d*(-a)^(1/2)/b^(1/
2))*(-a)^(1/2)/b^(5/2)+1/4*d*Ci(-d*x+d*(-a)^(1/2)/b^(1/2))*cos(c+d*(-a)^(1
/2)/b^(1/2))*(-a)^(1/2)/b^(5/2)+1/4*d*Si(d*x+d*(-a)^(1/2)/b^(1/2))*sin(c-d
*(-a)^(1/2)/b^(1/2))*(-a)^(1/2)/b^(5/2)-1/4*d*Si(d*x-d*(-a)^(1/2)/b^(1/2))
*sin(c+d*(-a)^(1/2)/b^(1/2))*(-a)^(1/2)/b^(5/2)
```

### 3.66.2 Mathematica [C] (verified)

Result contains complex when optimal does not.

Time = 1.82 (sec) , antiderivative size = 286, normalized size of antiderivative = 0.66

$$\int \frac{x^3 \sin(c+dx)}{(a+bx^2)^2} \, dx$$
$$= \frac{ie^{-ic-\frac{\sqrt{a}d}{\sqrt{b}}}\left(\left(2\sqrt{b}+\sqrt{a}d\right)e^{\frac{2\sqrt{a}d}{\sqrt{b}}}\text{ExpIntegralEi}\left(-\frac{\sqrt{a}d}{\sqrt{b}}-idx\right)+\left(2\sqrt{b}-\sqrt{a}d\right)\text{ExpIntegralEi}\left(\frac{\sqrt{a}d}{\sqrt{b}}-idx\right)\right.}{}$$

input
```
Integrate[(x^3*Sin[c + d*x])/(a + b*x^2)^2,x]
```

output
```
(I*E^((-I)*c - (Sqrt[a]*d)/Sqrt[b])*((2*Sqrt[b] + Sqrt[a]*d)*E^((2*Sqrt[a]
*d)/Sqrt[b])*ExpIntegralEi[-((Sqrt[a]*d)/Sqrt[b]) - I*d*x] + (2*Sqrt[b] -
Sqrt[a]*d)*ExpIntegralEi[(Sqrt[a]*d)/Sqrt[b] - I*d*x]) - I*E^(I*c - (Sqrt[
a]*d)/Sqrt[b])*((2*Sqrt[b] + Sqrt[a]*d)*E^((2*Sqrt[a]*d)/Sqrt[b])*ExpInteg
ralEi[-((Sqrt[a]*d)/Sqrt[b]) + I*d*x] + (2*Sqrt[b] - Sqrt[a]*d)*ExpIntegra
lEi[(Sqrt[a]*d)/Sqrt[b] + I*d*x]) + (4*a*Sqrt[b]*Cos[d*x]*Sin[c])/(a + b*x
^2) + (4*a*Sqrt[b]*Cos[c]*Sin[d*x])/(a + b*x^2))/(8*b^(5/2))
```

### 3.66.3 Rubi [A] (verified)

Time = 1.00 (sec) , antiderivative size = 441, normalized size of antiderivative = 1.02, number of steps used = 5, number of rules used = 5, $\frac{\text{number of rules}}{\text{integrand size}}$ = 0.263, Rules used = {3824, 3826, 2009, 3827, 2009}

Below are the steps used by Rubi to obtain the solution. The rule number used for the transformation is given above next to the arrow. The rules definitions used are listed below.

$$\int \frac{x^3 \sin(c+dx)}{(a+bx^2)^2} \, dx$$

$$\Big\downarrow \text{ 3824}$$

$$\frac{\int \frac{x \sin(c+dx)}{bx^2+a}dx}{b}+\frac{d\int \frac{x^2 \cos(c+dx)}{bx^2+a}dx}{2b}-\frac{x^2 \sin(c+dx)}{2b(a+bx^2)}$$

$$\Big\downarrow \text{ 3826}$$

$$\frac{d\int \frac{x^2 \cos(c+dx)}{bx^2+a}dx}{2b}+\frac{\int \left(\frac{\sin(c+dx)}{2\sqrt{b}\left(\sqrt{b}x+\sqrt{-a}\right)}-\frac{\sin(c+dx)}{2\sqrt{b}\left(\sqrt{-a}-\sqrt{b}x\right)}\right)dx}{b}-\frac{x^2 \sin(c+dx)}{2b(a+bx^2)}$$

$$\Big\downarrow \text{ 2009}$$

$$\frac{d\int \frac{x^2 \cos(c+dx)}{bx^2+a}dx}{2b}+\frac{\frac{\sin\left(c-\frac{\sqrt{-a}d}{\sqrt{b}}\right)\text{CosIntegral}\left(xd+\frac{\sqrt{-a}d}{\sqrt{b}}\right)}{2b}+\frac{\sin\left(\frac{\sqrt{-a}d}{\sqrt{b}}+c\right)\text{CosIntegral}\left(\frac{\sqrt{-a}d}{\sqrt{b}}-dx\right)}{2b}-\frac{\cos\left(\frac{\sqrt{-a}d}{\sqrt{b}}+c\right)\text{Si}\left(\frac{\sqrt{-a}d}{\sqrt{b}}-dx\right)}{2b}+\frac{\cos\left(c-\frac{\sqrt{-a}d}{\sqrt{b}}\right)\text{Si}\left(xd\right.}{2b}}{b}\frac{x^2 \sin(c+dx)}{2b(a+bx^2)}$$

$$\Big\downarrow \text{ 3827}$$

$$\frac{d\int \left(\frac{\cos(c+dx)}{b}-\frac{a\cos(c+dx)}{b(bx^2+a)}\right)dx}{2b}+\frac{\frac{\sin\left(c-\frac{\sqrt{-a}d}{\sqrt{b}}\right)\text{CosIntegral}\left(xd+\frac{\sqrt{-a}d}{\sqrt{b}}\right)}{2b}+\frac{\sin\left(\frac{\sqrt{-a}d}{\sqrt{b}}+c\right)\text{CosIntegral}\left(\frac{\sqrt{-a}d}{\sqrt{b}}-dx\right)}{2b}-\frac{\cos\left(\frac{\sqrt{-a}d}{\sqrt{b}}+c\right)\text{Si}\left(\frac{\sqrt{-a}d}{\sqrt{b}}-dx\right)}{2b}+\frac{\cos\left(c-\frac{\sqrt{-a}d}{\sqrt{b}}\right)\text{Si}\left(xd\right.}{2b}}{b}\frac{x^2 \sin(c+dx)}{2b(a+bx^2)}$$

$$\Big\downarrow \text{ 2009}$$

$$\frac{d\left(\frac{\sqrt{-a}\cos\left(\frac{\sqrt{-a}d}{\sqrt{b}}+c\right)\text{CosIntegral}\left(\frac{\sqrt{-a}d}{\sqrt{b}}-dx\right)}{2b^{3/2}}-\frac{\sqrt{-a}\cos\left(c-\frac{\sqrt{-a}d}{\sqrt{b}}\right)\text{CosIntegral}\left(xd+\frac{\sqrt{-a}d}{\sqrt{b}}\right)}{2b^{3/2}}+\frac{\sqrt{-a}\sin\left(\frac{\sqrt{-a}d}{\sqrt{b}}+c\right)\text{Si}\left(\frac{\sqrt{-a}d}{\sqrt{b}}-dx\right)}{2b^{3/2}}+\cdots}{2b}$$

$$\frac{\frac{\sin\left(c-\frac{\sqrt{-a}d}{\sqrt{b}}\right)\text{CosIntegral}\left(xd+\frac{\sqrt{-a}d}{\sqrt{b}}\right)}{2b}+\frac{\sin\left(\frac{\sqrt{-a}d}{\sqrt{b}}+c\right)\text{CosIntegral}\left(\frac{\sqrt{-a}d}{\sqrt{b}}-dx\right)}{2b}-\frac{\cos\left(\frac{\sqrt{-a}d}{\sqrt{b}}+c\right)\text{Si}\left(\frac{\sqrt{-a}d}{\sqrt{b}}-dx\right)}{2b}+\frac{\cos\left(c-\frac{\sqrt{-a}d}{\sqrt{b}}\right)\text{Si}\left(xd\cdots\right.}{2b}}{b}$$

$$\frac{x^2\sin(c+dx)}{2b\left(a+bx^2\right)}$$

input
```
Int[(x^3*Sin[c + d*x])/(a + b*x^2)^2,x]
```

output
```
-1/2*(x^2*Sin[c + d*x])/(b*(a + b*x^2)) + ((CosIntegral[(Sqrt[-a]*d)/Sqrt[
b] + d*x]*Sin[c - (Sqrt[-a]*d)/Sqrt[b]])/(2*b) + (CosIntegral[(Sqrt[-a]*d)
/Sqrt[b] - d*x]*Sin[c + (Sqrt[-a]*d)/Sqrt[b]])/(2*b) - (Cos[c + (Sqrt[-a]*
d)/Sqrt[b]]*SinIntegral[(Sqrt[-a]*d)/Sqrt[b] - d*x])/(2*b) + (Cos[c - (Sqr
t[-a]*d)/Sqrt[b]]*SinIntegral[(Sqrt[-a]*d)/Sqrt[b] + d*x])/(2*b))/b + (d*(
(Sqrt[-a]*Cos[c + (Sqrt[-a]*d)/Sqrt[b]]*CosIntegral[(Sqrt[-a]*d)/Sqrt[b] -
 d*x])/(2*b^(3/2)) - (Sqrt[-a]*Cos[c - (Sqrt[-a]*d)/Sqrt[b]]*CosIntegral[(
Sqrt[-a]*d)/Sqrt[b] + d*x])/(2*b^(3/2)) + Sin[c + d*x]/(b*d) + (Sqrt[-a]*S
in[c + (Sqrt[-a]*d)/Sqrt[b]]*SinIntegral[(Sqrt[-a]*d)/Sqrt[b] - d*x])/(2*b
^(3/2)) + (Sqrt[-a]*Sin[c - (Sqrt[-a]*d)/Sqrt[b]]*SinIntegral[(Sqrt[-a]*d)
/Sqrt[b] + d*x])/(2*b^(3/2))))/(2*b)
```

### 3.66.3.1 Defintions of rubi rules used

rule 2009
```
Int[u_, x_Symbol] :> Simp[IntSum[u, x], x] /; SumQ[u]
```

rule 3824
```
Int[(x_)^(m_.)*((a_) + (b_.)*(x_)^(n_))^(p_)*Sin[(c_.) + (d_.)*(x_)], x_Sym
bol] :> Simp[x^(m - n + 1)*(a + b*x^n)^(p + 1)*(Sin[c + d*x]/(b*n*(p + 1)))
, x] + (-Simp[(m - n + 1)/(b*n*(p + 1))   Int[x^(m - n)*(a + b*x^n)^(p + 1)
*Sin[c + d*x], x], x] - Simp[d/(b*n*(p + 1))   Int[x^(m - n + 1)*(a + b*x^n
)^(p + 1)*Cos[c + d*x], x], x]) /; FreeQ[{a, b, c, d, m}, x] && ILtQ[p, -1]
 && IGtQ[n, 0] && (GtQ[m - n + 1, 0] || GtQ[n, 2]) && RationalQ[m]
```

rule 3826
```
Int[(x_)^(m_.)*((a_) + (b_.)*(x_)^(n_))^(p_)*Sin[(c_.) + (d_.)*(x_)], x_Sym
bol] :> Int[ExpandIntegrand[Sin[c + d*x], x^m*(a + b*x^n)^p, x], x] /; Free
Q[{a, b, c, d, m}, x] && ILtQ[p, 0] && IGtQ[n, 0] && (EqQ[n, 2] || EqQ[p, -
1]) && IntegerQ[m]
```

rule 3827
```
Int[Cos[(c_.) + (d_.)*(x_)]*(x_)^(m_.)*((a_) + (b_.)*(x_)^(n_))^(p_), x_Sym
bol] :> Int[ExpandIntegrand[Cos[c + d*x], x^m*(a + b*x^n)^p, x], x] /; Free
Q[{a, b, c, d, m}, x] && ILtQ[p, 0] && IGtQ[n, 0] && (EqQ[n, 2] || EqQ[p, -
1]) && IntegerQ[m]
```

## 3.66.4 Maple [C] (verified)

Result contains complex when optimal does not.

Time = 0.63 (sec) , antiderivative size = 852, normalized size of antiderivative = 1.98

| method | result |
|---|---|
| risch | $\frac{i\sqrt{ab}\,\mathrm{e}^{\frac{icb+d\sqrt{ab}}{b}}\,\mathrm{Ei}_1\left(\frac{icb+d\sqrt{ab}-b(idx+ic)}{b}\right)d}{8b^3} - \frac{i\sqrt{ab}\,\mathrm{e}^{\frac{icb-d\sqrt{ab}}{b}}\,\mathrm{Ei}_1\left(\frac{icb-d\sqrt{ab}-b(idx+ic)}{b}\right)d}{8b^3} + \frac{i\mathrm{e}^{\frac{icb+d\sqrt{ab}}{b}}\,\mathrm{Ei}_1\left(\frac{icb+c}{}\right.}{4b^2}$ |
| derivativedivides | Expression too large to display |
| default | Expression too large to display |

input
```
int(x^3*sin(d*x+c)/(b*x^2+a)^2,x,method=_RETURNVERBOSE)
```

output
```
1/8*I/b^3*(a*b)^(1/2)*exp((I*c*b+d*(a*b)^(1/2))/b)*Ei(1,(I*c*b+d*(a*b)^(1/
2)-b*(I*d*x+I*c))/b)*d-1/8*I/b^3*(a*b)^(1/2)*exp((I*c*b-d*(a*b)^(1/2))/b)*
Ei(1,(I*c*b-d*(a*b)^(1/2)-b*(I*d*x+I*c))/b)*d+1/4*I/b^2*exp((I*c*b+d*(a*b)
^(1/2))/b)*Ei(1,(I*c*b+d*(a*b)^(1/2)-b*(I*d*x+I*c))/b)+1/4*I/b^2*exp((I*c*
b-d*(a*b)^(1/2))/b)*Ei(1,(I*c*b-d*(a*b)^(1/2)-b*(I*d*x+I*c))/b)+1/8*I/b^3*
exp(-(I*c*b+d*(a*b)^(1/2))/b)*Ei(1,-(I*c*b+d*(a*b)^(1/2)-b*(I*d*x+I*c))/b)
*(a*b)^(1/2)*d-1/8*I/b^3*exp(-(I*c*b-d*(a*b)^(1/2))/b)*Ei(1,-(I*c*b-d*(a*b
)^(1/2)-b*(I*d*x+I*c))/b)*(a*b)^(1/2)*d-1/4*I/b^2*exp(-(I*c*b+d*(a*b)^(1/2
))/b)*Ei(1,-(I*c*b+d*(a*b)^(1/2)-b*(I*d*x+I*c))/b)-1/4*I/b^2*exp(-(I*c*b-d
*(a*b)^(1/2))/b)*Ei(1,-(I*c*b-d*(a*b)^(1/2)-b*(I*d*x+I*c))/b)+1/d^4*(1/2/(
2*I*(I*d*x+I*c)*b*c-b*(I*d*x+I*c)^2+a*d^2+c^2*b)/b^2/a*(3*I*(I*d*x+I*c)*a*
b*c*d^2-I*(I*d*x+I*c)*b^2*c^3+a^2*d^4-b^2*c^4)*d^2+1/2*c^3*d^3*x/(-2*I*(I*
d*x+I*c)*b*c+b*(I*d*x+I*c)^2-a*d^2-c^2*b)/a-3/2*c^2*d^2*(I*(I*d*x+I*c)*b*c
+a*d^2+c^2*b)/a/b/(2*I*(I*d*x+I*c)*b*c-b*(I*d*x+I*c)^2+a*d^2+c^2*b)-3/2*I*
c*d^2*(-I*a*c*d^2-I*b*c^3-(I*d*x+I*c)*a*d^2+(I*d*x+I*c)*b*c^2)/a/b/(-2*I*(
I*d*x+I*c)*b*c+b*(I*d*x+I*c)^2-a*d^2-c^2*b))*sin(d*x+c)
```

### 3.66.5 Fricas [C] (verification not implemented)

Result contains complex when optimal does not.

Time = 0.32 (sec) , antiderivative size = 291, normalized size of antiderivative = 0.68

$$\int \frac{x^3 \sin(c+dx)}{(a+bx^2)^2}\, dx =$$
$$-\frac{\left(2i\, bx^2 - (-i\, bx^2 - i\, a)\sqrt{\frac{ad^2}{b}} + 2i\, a\right)\mathrm{Ei}\left(i\, dx - \sqrt{\frac{ad^2}{b}}\right)e^{\left(i\, c+\sqrt{\frac{ad^2}{b}}\right)} + \left(2i\, bx^2 - (i\, bx^2 + i\, a)\sqrt{\frac{ad^2}{b}} + 2i\right.}{}$$

input
```
integrate(x^3*sin(d*x+c)/(b*x^2+a)^2,x, algorithm="fricas")
```

output
```
-1/8*((2*I*b*x^2 - (-I*b*x^2 - I*a)*sqrt(a*d^2/b) + 2*I*a)*Ei(I*d*x - sqrt
(a*d^2/b))*e^(I*c + sqrt(a*d^2/b)) + (2*I*b*x^2 - (I*b*x^2 + I*a)*sqrt(a*d
^2/b) + 2*I*a)*Ei(I*d*x + sqrt(a*d^2/b))*e^(I*c - sqrt(a*d^2/b)) + (-2*I*b
*x^2 - (I*b*x^2 + I*a)*sqrt(a*d^2/b) - 2*I*a)*Ei(-I*d*x - sqrt(a*d^2/b))*e
^(-I*c + sqrt(a*d^2/b)) + (-2*I*b*x^2 - (-I*b*x^2 - I*a)*sqrt(a*d^2/b) - 2
*I*a)*Ei(-I*d*x + sqrt(a*d^2/b))*e^(-I*c - sqrt(a*d^2/b)) - 4*a*sin(d*x +
c))/(b^3*x^2 + a*b^2)
```

### 3.66.6 Sympy [F]

$$\int \frac{x^3 \sin(c+dx)}{(a+bx^2)^2}\, dx = \int \frac{x^3 \sin{(c+dx)}}{(a+bx^2)^2}\, dx$$

input
```
integrate(x**3*sin(d*x+c)/(b*x**2+a)**2,x)
```

output
```
Integral(x**3*sin(c + d*x)/(a + b*x**2)**2, x)
```

### 3.66.7 Maxima [F]

$$\int \frac{x^3 \sin(c+dx)}{(a+bx^2)^2}\,dx = \int \frac{x^3 \sin(dx+c)}{(bx^2+a)^2}\,dx$$

input
```
integrate(x^3*sin(d*x+c)/(b*x^2+a)^2,x, algorithm="maxima")
```

output
```
-1/2*((cos(c)^2 + sin(c)^2)*d*x^2*sin(d*x + c) + ((d^2*x^3*cos(c) - d*x^2*
sin(c) - 2*x*cos(c))*cos(d*x + c)^2 + (d^2*x^3*cos(c) - d*x^2*sin(c) - 2*x
*cos(c))*sin(d*x + c)^2)*cos(d*x + 2*c) + ((cos(c)^2 + sin(c)^2)*d^2*x^3 -
 2*(cos(c)^2 + sin(c)^2)*x)*cos(d*x + c) - 2*(((b^2*cos(c)^2 + b^2*sin(c)^
2)*d^3*x^4 + 2*(a*b*cos(c)^2 + a*b*sin(c)^2)*d^3*x^2 + (a^2*cos(c)^2 + a^2
*sin(c)^2)*d^3)*cos(d*x + c)^2 + ((b^2*cos(c)^2 + b^2*sin(c)^2)*d^3*x^4 +
2*(a*b*cos(c)^2 + a*b*sin(c)^2)*d^3*x^2 + (a^2*cos(c)^2 + a^2*sin(c)^2)*d^
3)*sin(d*x + c)^2)*integrate((2*a*d*x*sin(d*x + c) + ((2*a*d^2 + 3*b)*x^2
- a)*cos(d*x + c))/(b^3*d^3*x^6 + 3*a*b^2*d^3*x^4 + 3*a^2*b*d^3*x^2 + a^3*
d^3), x) - 2*(((b^2*cos(c)^2 + b^2*sin(c)^2)*d^3*x^4 + 2*(a*b*cos(c)^2 + a
*b*sin(c)^2)*d^3*x^2 + (a^2*cos(c)^2 + a^2*sin(c)^2)*d^3)*cos(d*x + c)^2 +
 ((b^2*cos(c)^2 + b^2*sin(c)^2)*d^3*x^4 + 2*(a*b*cos(c)^2 + a*b*sin(c)^2)*
d^3*x^2 + (a^2*cos(c)^2 + a^2*sin(c)^2)*d^3)*sin(d*x + c)^2)*integrate((2*
a*d*x*sin(d*x + c) + ((2*a*d^2 + 3*b)*x^2 - a)*cos(d*x + c))/((b^3*d^3*x^6
 + 3*a*b^2*d^3*x^4 + 3*a^2*b*d^3*x^2 + a^3*d^3)*cos(d*x + c)^2 + (b^3*d^3*
x^6 + 3*a*b^2*d^3*x^4 + 3*a^2*b*d^3*x^2 + a^3*d^3)*sin(d*x + c)^2), x) + (
(d^2*x^3*sin(c) + d*x^2*cos(c) - 2*x*sin(c))*cos(d*x + c)^2 + (d^2*x^3*sin
(c) + d*x^2*cos(c) - 2*x*sin(c))*sin(d*x + c)^2)*sin(d*x + 2*c))/(((b^2*co
s(c)^2 + b^2*sin(c)^2)*d^3*x^4 + 2*(a*b*cos(c)^2 + a*b*sin(c)^2)*d^3*x^2 +
 (a^2*cos(c)^2 + a^2*sin(c)^2)*d^3)*cos(d*x + c)^2 + ((b^2*cos(c)^2 + b...
```

### 3.66.8 Giac [F]

$$\int \frac{x^3 \sin(c+dx)}{(a+bx^2)^2}\,dx = \int \frac{x^3 \sin(dx+c)}{(bx^2+a)^2}\,dx$$

input
```
integrate(x^3*sin(d*x+c)/(b*x^2+a)^2,x, algorithm="giac")
```

output
```
integrate(x^3*sin(d*x + c)/(b*x^2 + a)^2, x)
```

### 3.66.9 Mupad [F(-1)]

Timed out.

$$\int \frac{x^3 \sin(c+dx)}{(a+bx^2)^2}\,dx = \int \frac{x^3\,\sin(c+d\,x)}{(b\,x^2+a)^2}\,dx$$

input
```
int((x^3*sin(c + d*x))/(a + b*x^2)^2,x)
```

output
```
int((x^3*sin(c + d*x))/(a + b*x^2)^2, x)
```

# 3.67 $\int \frac{x^2 \sin(c+dx)}{(a+bx^2)^2}\,dx$



## 3.67.1 Optimal result

Integrand size = 19, antiderivative size = 416

$$
\begin{aligned}
\int \frac{x^2 \sin(c+dx)}{(a+bx^2)^2}\,dx &= \frac{d\cos\left(c+\frac{\sqrt{-a}d}{\sqrt{b}}\right)\operatorname{CosIntegral}\left(\frac{\sqrt{-a}d}{\sqrt{b}}-dx\right)}{4b^2} \\
&+ \frac{d\cos\left(c-\frac{\sqrt{-a}d}{\sqrt{b}}\right)\operatorname{CosIntegral}\left(\frac{\sqrt{-a}d}{\sqrt{b}}+dx\right)}{4b^2} \\
&- \frac{\operatorname{CosIntegral}\left(\frac{\sqrt{-a}d}{\sqrt{b}}+dx\right)\sin\left(c-\frac{\sqrt{-a}d}{\sqrt{b}}\right)}{4\sqrt{-a}b^{3/2}} \\
&+ \frac{\operatorname{CosIntegral}\left(\frac{\sqrt{-a}d}{\sqrt{b}}-dx\right)\sin\left(c+\frac{\sqrt{-a}d}{\sqrt{b}}\right)}{4\sqrt{-a}b^{3/2}} - \frac{x\sin(c+dx)}{2b(a+bx^2)} \\
&- \frac{\cos\left(c+\frac{\sqrt{-a}d}{\sqrt{b}}\right)\operatorname{Si}\left(\frac{\sqrt{-a}d}{\sqrt{b}}-dx\right)}{4\sqrt{-a}b^{3/2}} + \frac{d\sin\left(c+\frac{\sqrt{-a}d}{\sqrt{b}}\right)\operatorname{Si}\left(\frac{\sqrt{-a}d}{\sqrt{b}}-dx\right)}{4b^2} \\
&- \frac{\cos\left(c-\frac{\sqrt{-a}d}{\sqrt{b}}\right)\operatorname{Si}\left(\frac{\sqrt{-a}d}{\sqrt{b}}+dx\right)}{4\sqrt{-a}b^{3/2}} - \frac{d\sin\left(c-\frac{\sqrt{-a}d}{\sqrt{b}}\right)\operatorname{Si}\left(\frac{\sqrt{-a}d}{\sqrt{b}}+dx\right)}{4b^2}
\end{aligned}
$$

output
```
1/4*d*Ci(d*x+d*(-a)^(1/2)/b^(1/2))*cos(c-d*(-a)^(1/2)/b^(1/2))/b^2+1/4*d*C
i(-d*x+d*(-a)^(1/2)/b^(1/2))*cos(c+d*(-a)^(1/2)/b^(1/2))/b^2-1/2*x*sin(d*x
+c)/b/(b*x^2+a)-1/4*d*Si(d*x+d*(-a)^(1/2)/b^(1/2))*sin(c-d*(-a)^(1/2)/b^(1
/2))/b^2-1/4*d*Si(d*x-d*(-a)^(1/2)/b^(1/2))*sin(c+d*(-a)^(1/2)/b^(1/2))/b^
2+1/4*cos(c+d*(-a)^(1/2)/b^(1/2))*Si(d*x-d*(-a)^(1/2)/b^(1/2))/b^(3/2)/(-a
)^(1/2)-1/4*cos(c-d*(-a)^(1/2)/b^(1/2))*Si(d*x+d*(-a)^(1/2)/b^(1/2))/b^(3/
2)/(-a)^(1/2)-1/4*Ci(d*x+d*(-a)^(1/2)/b^(1/2))*sin(c-d*(-a)^(1/2)/b^(1/2))
/b^(3/2)/(-a)^(1/2)+1/4*Ci(-d*x+d*(-a)^(1/2)/b^(1/2))*sin(c+d*(-a)^(1/2)/b
^(1/2))/b^(3/2)/(-a)^(1/2)
```

### 3.67.2 Mathematica [C] (verified)

Result contains complex when optimal does not.

Time = 2.01 (sec) , antiderivative size = 274, normalized size of antiderivative = 0.66

$$\int \frac{x^2\sin(c+dx)}{(a+bx^2)^2}\,dx$$
$$= \frac{\frac{e^{-ic-\frac{\sqrt{a}d}{\sqrt{b}}}\left(\left(\sqrt{b}+\sqrt{a}d\right)e^{\frac{2\sqrt{a}d}{\sqrt{b}}}\text{ExpIntegralEi}\left(-\frac{\sqrt{a}d}{\sqrt{b}}-idx\right)+\left(-\sqrt{b}+\sqrt{a}d\right)\text{ExpIntegralEi}\left(\frac{\sqrt{a}d}{\sqrt{b}}-idx\right)\right)}{\sqrt{a}}+\frac{e^{ic-\frac{\sqrt{a}d}{\sqrt{b}}}\left(\left(\sqrt{b}+\sqrt{a}d\right)e^{\frac{2\sqrt{a}d}{\sqrt{b}}}\text{Expl}\right.}{}}{8b^2}$$

input
```
Integrate[(x^2*Sin[c + d*x])/(a + b*x^2)^2,x]
```

output
```
((E^((-I)*c - (Sqrt[a]*d)/Sqrt[b])*((Sqrt[b] + Sqrt[a]*d)*E^((2*Sqrt[a]*d)
/Sqrt[b])*ExpIntegralEi[-((Sqrt[a]*d)/Sqrt[b]) - I*d*x] + (-Sqrt[b] + Sqrt
[a]*d)*ExpIntegralEi[(Sqrt[a]*d)/Sqrt[b] - I*d*x]))/Sqrt[a] + (E^(I*c - (S
qrt[a]*d)/Sqrt[b])*((Sqrt[b] + Sqrt[a]*d)*E^((2*Sqrt[a]*d)/Sqrt[b])*ExpInt
egralEi[-((Sqrt[a]*d)/Sqrt[b]) + I*d*x] + (-Sqrt[b] + Sqrt[a]*d)*ExpIntegr
alEi[(Sqrt[a]*d)/Sqrt[b] + I*d*x]))/Sqrt[a] - (4*b*x*Cos[d*x]*Sin[c])/(a +
 b*x^2) - (4*b*x*Cos[c]*Sin[d*x])/(a + b*x^2))/(8*b^2)
```

### 3.67.3 Rubi [A] (verified)

Time = 0.96 (sec) , antiderivative size = 429, normalized size of antiderivative = 1.03, number of steps used = 5, number of rules used = 5, $\frac{\text{number of rules}}{\text{integrand size}}$ = 0.263, Rules used = {3824, 3814, 2009, 3827, 2009}

Below are the steps used by Rubi to obtain the solution. The rule number used for the transformation is given above next to the arrow. The rules definitions used are listed below.

$$\int \frac{x^2 \sin(c+dx)}{(a+bx^2)^2} \, dx$$

$$\Big\downarrow \ 3824$$

$$\frac{\int \frac{\sin(c+dx)}{bx^2+a}dx}{2b}+\frac{d\int \frac{x\cos(c+dx)}{bx^2+a}dx}{2b}-\frac{x\sin(c+dx)}{2b(a+bx^2)}$$

$$\Big\downarrow \ 3814$$

$$\frac{d\int \frac{x\cos(c+dx)}{bx^2+a}dx}{2b}+\frac{\int \left(\frac{\sqrt{-a}\sin(c+dx)}{2a\left(\sqrt{-a}-\sqrt{b}x\right)}+\frac{\sqrt{-a}\sin(c+dx)}{2a\left(\sqrt{b}x+\sqrt{-a}\right)}\right)dx}{2b}-\frac{x\sin(c+dx)}{2b(a+bx^2)}$$

$$\Big\downarrow \ 2009$$

$$\frac{d\int \frac{x\cos(c+dx)}{bx^2+a}dx}{2b}+\frac{-\frac{\sin\left(c-\frac{\sqrt{-a}d}{\sqrt{b}}\right)\text{CosIntegral}\left(xd+\frac{\sqrt{-a}d}{\sqrt{b}}\right)}{2\sqrt{-a}\sqrt{b}}+\frac{\sin\left(\frac{\sqrt{-a}d}{\sqrt{b}}+c\right)\text{CosIntegral}\left(\frac{\sqrt{-a}d}{\sqrt{b}}-dx\right)}{2\sqrt{-a}\sqrt{b}}-\frac{\cos\left(\frac{\sqrt{-a}d}{\sqrt{b}}+c\right)\text{Si}\left(\frac{\sqrt{-a}d}{\sqrt{b}}-dx\right)}{2\sqrt{-a}\sqrt{b}}-\frac{\cos\left(c-\frac{\sqrt{-a}d}{\sqrt{b}}\right)\text{Si}(\cdots}{2\sqrt{-a}\sqrt{\cdots}}}{2b}-\frac{x\sin(c+dx)}{2b(a+bx^2)}$$

$$\Big\downarrow \ 3827$$

$$\frac{d\int \left(\frac{\cos(c+dx)}{2\sqrt{b}\left(\sqrt{b}x+\sqrt{-a}\right)}-\frac{\cos(c+dx)}{2\sqrt{b}\left(\sqrt{-a}-\sqrt{b}x\right)}\right)dx}{2b}+\frac{-\frac{\sin\left(c-\frac{\sqrt{-a}d}{\sqrt{b}}\right)\text{CosIntegral}\left(xd+\frac{\sqrt{-a}d}{\sqrt{b}}\right)}{2\sqrt{-a}\sqrt{b}}+\frac{\sin\left(\frac{\sqrt{-a}d}{\sqrt{b}}+c\right)\text{CosIntegral}\left(\frac{\sqrt{-a}d}{\sqrt{b}}-dx\right)}{2\sqrt{-a}\sqrt{b}}-\frac{\cos\left(\frac{\sqrt{-a}d}{\sqrt{b}}+c\right)\text{Si}\left(\frac{\sqrt{-a}d}{\sqrt{b}}-dx\right)}{2\sqrt{-a}\sqrt{b}}-\frac{\cos\left(c-\frac{\sqrt{-a}d}{\sqrt{b}}\right)\text{Si}(\cdots}{2\sqrt{-a}\sqrt{\cdots}}}{2b}-\frac{x\sin(c+dx)}{2b(a+bx^2)}$$

$$\Big\downarrow \ 2009$$

$$-\frac{-\frac{\sin\left(c-\frac{\sqrt{-a}d}{\sqrt{b}}\right)\text{CosIntegral}\left(xd+\frac{\sqrt{-a}d}{\sqrt{b}}\right)}{2\sqrt{-a}\sqrt{b}}+\frac{\sin\left(\frac{\sqrt{-a}d}{\sqrt{b}}+c\right)\text{CosIntegral}\left(\frac{\sqrt{-a}d}{\sqrt{b}}-dx\right)}{2\sqrt{-a}\sqrt{b}}-\frac{\cos\left(\frac{\sqrt{-a}d}{\sqrt{b}}+c\right)\text{Si}\left(\frac{\sqrt{-a}d}{\sqrt{b}}-dx\right)}{2\sqrt{-a}\sqrt{b}}-\frac{\cos\left(c-\frac{\sqrt{-a}d}{\sqrt{b}}\right)\text{Si}(\ldots}{2\sqrt{-a}\sqrt{\ldots}}}{2b}$$

$$\frac{d\left(\frac{\cos\left(\frac{\sqrt{-a}d}{\sqrt{b}}+c\right)\text{CosIntegral}\left(\frac{\sqrt{-a}d}{\sqrt{b}}-dx\right)}{2b}+\frac{\cos\left(c-\frac{\sqrt{-a}d}{\sqrt{b}}\right)\text{CosIntegral}\left(xd+\frac{\sqrt{-a}d}{\sqrt{b}}\right)}{2b}+\frac{\sin\left(\frac{\sqrt{-a}d}{\sqrt{b}}+c\right)\text{Si}\left(\frac{\sqrt{-a}d}{\sqrt{b}}-dx\right)}{2b}-\frac{\sin\left(c-\frac{\sqrt{-a}d}{\sqrt{b}}\right)\text{Si}\ldots}{2b}\right.}{2b}$$

$$\frac{x\sin(c+dx)}{2b\,(a+bx^2)}$$

input
```
Int[(x^2*Sin[c + d*x])/(a + b*x^2)^2,x]
```

output
```
-1/2*(x*Sin[c + d*x])/(b*(a + b*x^2)) + (-1/2*(CosIntegral[(Sqrt[-a]*d)/Sq
rt[b] + d*x]*Sin[c - (Sqrt[-a]*d)/Sqrt[b]])/(Sqrt[-a]*Sqrt[b]) + (CosInteg
ral[(Sqrt[-a]*d)/Sqrt[b] - d*x]*Sin[c + (Sqrt[-a]*d)/Sqrt[b]])/(2*Sqrt[-a]
*Sqrt[b]) - (Cos[c + (Sqrt[-a]*d)/Sqrt[b]]*SinIntegral[(Sqrt[-a]*d)/Sqrt[b
] - d*x])/(2*Sqrt[-a]*Sqrt[b]) - (Cos[c - (Sqrt[-a]*d)/Sqrt[b]]*SinIntegra
l[(Sqrt[-a]*d)/Sqrt[b] + d*x])/(2*Sqrt[-a]*Sqrt[b]))/(2*b) + (d*((Cos[c +
(Sqrt[-a]*d)/Sqrt[b]]*CosIntegral[(Sqrt[-a]*d)/Sqrt[b] - d*x])/(2*b) + (Co
s[c - (Sqrt[-a]*d)/Sqrt[b]]*CosIntegral[(Sqrt[-a]*d)/Sqrt[b] + d*x])/(2*b)
 + (Sin[c + (Sqrt[-a]*d)/Sqrt[b]]*SinIntegral[(Sqrt[-a]*d)/Sqrt[b] - d*x])
/(2*b) - (Sin[c - (Sqrt[-a]*d)/Sqrt[b]]*SinIntegral[(Sqrt[-a]*d)/Sqrt[b] +
 d*x])/(2*b)))/(2*b)
```

### 3.67.3.1 Defintions of rubi rules used

rule 2009
```
Int[u_, x_Symbol] :> Simp[IntSum[u, x], x] /; SumQ[u]
```

rule 3814
```
Int[((a_) + (b_.)*(x_)^(n_))^(p_)*Sin[(c_.) + (d_.)*(x_)], x_Symbol] :> Int
[ExpandIntegrand[Sin[c + d*x], (a + b*x^n)^p, x], x] /; FreeQ[{a, b, c, d},
 x] && ILtQ[p, 0] && IGtQ[n, 0] && (EqQ[n, 2] || EqQ[p, -1])
```

rule 3824
```
Int[(x_)^(m_.)*((a_) + (b_.)*(x_)^(n_))^(p_)*Sin[(c_.) + (d_.)*(x_)], x_Sym
bol] :> Simp[x^(m - n + 1)*(a + b*x^n)^(p + 1)*(Sin[c + d*x]/(b*n*(p + 1)))
, x] + (-Simp[(m - n + 1)/(b*n*(p + 1))   Int[x^(m - n)*(a + b*x^n)^(p + 1)
*Sin[c + d*x], x], x] - Simp[d/(b*n*(p + 1))   Int[x^(m - n + 1)*(a + b*x^n
)^(p + 1)*Cos[c + d*x], x], x]) /; FreeQ[{a, b, c, d, m}, x] && ILtQ[p, -1]
 && IGtQ[n, 0] && (GtQ[m - n + 1, 0] || GtQ[n, 2]) && RationalQ[m]
```

rule 3827
```
Int[Cos[(c_.) + (d_.)*(x_)]*(x_)^(m_.)*((a_) + (b_.)*(x_)^(n_))^(p_), x_Sym
bol] :> Int[ExpandIntegrand[Cos[c + d*x], x^m*(a + b*x^n)^p, x], x] /; Free
Q[{a, b, c, d, m}, x] && ILtQ[p, 0] && IGtQ[n, 0] && (EqQ[n, 2] || EqQ[p, -
1]) && IntegerQ[m]
```

### 3.67.4 Maple [C] (verified)

Result contains complex when optimal does not.

Time = 0.52 (sec) , antiderivative size = 748, normalized size of antiderivative = 1.80

| method | result |
|---|---|
| risch | $-\frac{\operatorname{Ei}_1\left(\frac{icb+d\sqrt{ab}-b(idx+ic)}{b}\right)\mathrm{e}^{\frac{icb+d\sqrt{ab}}{b}}d}{8b^2}-\frac{\operatorname{Ei}_1\left(\frac{icb-d\sqrt{ab}-b(idx+ic)}{b}\right)\mathrm{e}^{\frac{icb-d\sqrt{ab}}{b}}d}{8b^2}-\frac{\operatorname{Ei}_1\left(\frac{icb+d\sqrt{ab}-b(idx+ic)}{b}\right)\mathrm{e}^{\frac{icb-}{}}}{8a\,b^2}$ |
| derivativedivides | Expression too large to display |
| default | Expression too large to display |

input
```
int(x^2*sin(d*x+c)/(b*x^2+a)^2,x,method=_RETURNVERBOSE)
```

output
```
-1/8/b^2*Ei(1,(I*c*b+d*(a*b)^(1/2)-b*(I*d*x+I*c))/b)*exp((I*c*b+d*(a*b)^(1
/2))/b)*d-1/8/b^2*Ei(1,(I*c*b-d*(a*b)^(1/2)-b*(I*d*x+I*c))/b)*exp((I*c*b-d
*(a*b)^(1/2))/b)*d-1/8/a/b^2*Ei(1,(I*c*b+d*(a*b)^(1/2)-b*(I*d*x+I*c))/b)*e
xp((I*c*b+d*(a*b)^(1/2))/b)*(a*b)^(1/2)+1/8/a/b^2*Ei(1,(I*c*b-d*(a*b)^(1/2
)-b*(I*d*x+I*c))/b)*exp((I*c*b-d*(a*b)^(1/2))/b)*(a*b)^(1/2)-1/8/b^2*Ei(1,
-(I*c*b+d*(a*b)^(1/2)-b*(I*d*x+I*c))/b)*exp(-(I*c*b+d*(a*b)^(1/2))/b)*d-1/
8/b^2*Ei(1,-(I*c*b-d*(a*b)^(1/2)-b*(I*d*x+I*c))/b)*exp(-(I*c*b-d*(a*b)^(1/
2))/b)*d+1/8/a/b^2*Ei(1,-(I*c*b+d*(a*b)^(1/2)-b*(I*d*x+I*c))/b)*(a*b)^(1/2
)*exp(-(I*c*b+d*(a*b)^(1/2))/b)-1/8/a/b^2*Ei(1,-(I*c*b-d*(a*b)^(1/2)-b*(I*
d*x+I*c))/b)*(a*b)^(1/2)*exp(-(I*c*b-d*(a*b)^(1/2))/b)+I/d^3*(1/2/(-2*I*(I
*d*x+I*c)*b*c+b*(I*d*x+I*c)^2-a*d^2-c^2*b)/b/a*(-I*a*c*d^2-I*b*c^3-(I*d*x+
I*c)*a*d^2+(I*d*x+I*c)*b*c^2)*d^2+1/2*I*c^2*d^3*x/(-2*I*(I*d*x+I*c)*b*c+b*
(I*d*x+I*c)^2-a*d^2-c^2*b)/a-I*c*d^2*(I*(I*d*x+I*c)*b*c+a*d^2+c^2*b)/a/b/(
2*I*(I*d*x+I*c)*b*c-b*(I*d*x+I*c)^2+a*d^2+c^2*b))*sin(d*x+c)
```

### 3.67.5 Fricas [C] (verification not implemented)

Result contains complex when optimal does not.

Time = 0.30 (sec) , antiderivative size = 333, normalized size of antiderivative = 0.80

$$\int \frac{x^2 \sin(c+dx)}{(a+bx^2)^2} dx =$$

$$-\frac{4\,abdx \sin\left(dx+c\right) - \left(abd^2x^2 + a^2d^2 + (b^2x^2+ab)\sqrt{\frac{ad^2}{b}}\right)\mathrm{Ei}\left(i\,dx - \sqrt{\frac{ad^2}{b}}\right)e^{\left(i\,c+\sqrt{\frac{ad^2}{b}}\right)} - \left(abd^2x^2 + \right.}{}$$

input
```
integrate(x^2*sin(d*x+c)/(b*x^2+a)^2,x, algorithm="fricas")
```

output
```
-1/8*(4*a*b*d*x*sin(d*x + c) - (a*b*d^2*x^2 + a^2*d^2 + (b^2*x^2 + a*b)*sq
rt(a*d^2/b))*Ei(I*d*x - sqrt(a*d^2/b))*e^(I*c + sqrt(a*d^2/b)) - (a*b*d^2*
x^2 + a^2*d^2 - (b^2*x^2 + a*b)*sqrt(a*d^2/b))*Ei(I*d*x + sqrt(a*d^2/b))*e
^(I*c - sqrt(a*d^2/b)) - (a*b*d^2*x^2 + a^2*d^2 + (b^2*x^2 + a*b)*sqrt(a*d
^2/b))*Ei(-I*d*x - sqrt(a*d^2/b))*e^(-I*c + sqrt(a*d^2/b)) - (a*b*d^2*x^2
+ a^2*d^2 - (b^2*x^2 + a*b)*sqrt(a*d^2/b))*Ei(-I*d*x + sqrt(a*d^2/b))*e^(-
I*c - sqrt(a*d^2/b)))/(a*b^3*d*x^2 + a^2*b^2*d)
```

### 3.67.6 Sympy [F]

$$\int \frac{x^2 \sin(c+dx)}{(a+bx^2)^2} dx = \int \frac{x^2 \sin\left(c+dx\right)}{\left(a+bx^2\right)^2} dx$$

input
```
integrate(x**2*sin(d*x+c)/(b*x**2+a)**2,x)
```

output
```
Integral(x**2*sin(c + d*x)/(a + b*x**2)**2, x)
```

### 3.67.7 Maxima [F]

$$\int \frac{x^2 \sin(c+dx)}{(a+bx^2)^2} \, dx = \int \frac{x^2 \sin(dx+c)}{(bx^2+a)^2} \, dx$$

input
```
integrate(x^2*sin(d*x+c)/(b*x^2+a)^2,x, algorithm="maxima")
```

output
```
-1/2*((cos(c)^2 + sin(c)^2)*d*x^2*cos(d*x + c) + 2*(cos(c)^2 + sin(c)^2)*x
*sin(d*x + c) + ((d*x^2*cos(c) - 2*x*sin(c))*cos(d*x + c)^2 + (d*x^2*cos(c
) - 2*x*sin(c))*sin(d*x + c)^2)*cos(d*x + 2*c) + 2*(((b^2*cos(c)^2 + b^2*s
in(c)^2)*d^2*x^4 + 2*(a*b*cos(c)^2 + a*b*sin(c)^2)*d^2*x^2 + (a^2*cos(c)^2
 + a^2*sin(c)^2)*d^2)*cos(d*x + c)^2 + ((b^2*cos(c)^2 + b^2*sin(c)^2)*d^2*
x^4 + 2*(a*b*cos(c)^2 + a*b*sin(c)^2)*d^2*x^2 + (a^2*cos(c)^2 + a^2*sin(c)
^2)*d^2)*sin(d*x + c)^2)*integrate(-(2*a*d*x*cos(d*x + c) - (3*b*x^2 - a)*
sin(d*x + c))/(b^3*d^2*x^6 + 3*a*b^2*d^2*x^4 + 3*a^2*b*d^2*x^2 + a^3*d^2),
 x) + 2*(((b^2*cos(c)^2 + b^2*sin(c)^2)*d^2*x^4 + 2*(a*b*cos(c)^2 + a*b*si
n(c)^2)*d^2*x^2 + (a^2*cos(c)^2 + a^2*sin(c)^2)*d^2)*cos(d*x + c)^2 + ((b^
2*cos(c)^2 + b^2*sin(c)^2)*d^2*x^4 + 2*(a*b*cos(c)^2 + a*b*sin(c)^2)*d^2*x
^2 + (a^2*cos(c)^2 + a^2*sin(c)^2)*d^2)*sin(d*x + c)^2)*integrate(-(2*a*d*
x*cos(d*x + c) - (3*b*x^2 - a)*sin(d*x + c))/((b^3*d^2*x^6 + 3*a*b^2*d^2*x
^4 + 3*a^2*b*d^2*x^2 + a^3*d^2)*cos(d*x + c)^2 + (b^3*d^2*x^6 + 3*a*b^2*d^
2*x^4 + 3*a^2*b*d^2*x^2 + a^3*d^2)*sin(d*x + c)^2), x) + ((d*x^2*sin(c) +
2*x*cos(c))*cos(d*x + c)^2 + (d*x^2*sin(c) + 2*x*cos(c))*sin(d*x + c)^2)*s
in(d*x + 2*c))/(((b^2*cos(c)^2 + b^2*sin(c)^2)*d^2*x^4 + 2*(a*b*cos(c)^2 +
 a*b*sin(c)^2)*d^2*x^2 + (a^2*cos(c)^2 + a^2*sin(c)^2)*d^2)*cos(d*x + c)^2
 + ((b^2*cos(c)^2 + b^2*sin(c)^2)*d^2*x^4 + 2*(a*b*cos(c)^2 + a*b*sin(c)^2
)*d^2*x^2 + (a^2*cos(c)^2 + a^2*sin(c)^2)*d^2)*sin(d*x + c)^2)
```

### 3.67.8 Giac [F]

$$\int \frac{x^2 \sin(c+dx)}{(a+bx^2)^2} \, dx = \int \frac{x^2 \sin(dx+c)}{(bx^2+a)^2} \, dx$$

input
```
integrate(x^2*sin(d*x+c)/(b*x^2+a)^2,x, algorithm="giac")
```

output
```
integrate(x^2*sin(d*x + c)/(b*x^2 + a)^2, x)
```

### 3.67.9 Mupad [F(-1)]

Timed out.

$$\int \frac{x^2 \sin(c+dx)}{(a+bx^2)^2} \, dx = \int \frac{x^2 \sin(c+d\,x)}{(b\,x^2+a)^2} \, dx$$

input
```
int((x^2*sin(c + d*x))/(a + b*x^2)^2,x)
```

output
```
int((x^2*sin(c + d*x))/(a + b*x^2)^2, x)
```

# 3.68 $\int \frac{x\sin(c+dx)}{(a+bx^2)^2}\,dx$



## 3.68.1 Optimal result

Integrand size = 17, antiderivative size = 239

$$\begin{aligned}\int \frac{x\sin(c+dx)}{(a+bx^2)^2}\,dx &= \frac{d\cos\left(c+\frac{\sqrt{-a}d}{\sqrt{b}}\right)\text{CosIntegral}\left(\frac{\sqrt{-a}d}{\sqrt{b}}-dx\right)}{4\sqrt{-a}b^{3/2}} \\ &\quad - \frac{d\cos\left(c-\frac{\sqrt{-a}d}{\sqrt{b}}\right)\text{CosIntegral}\left(\frac{\sqrt{-a}d}{\sqrt{b}}+dx\right)}{4\sqrt{-a}b^{3/2}} - \frac{\sin(c+dx)}{2b(a+bx^2)} \\ &\quad + \frac{d\sin\left(c+\frac{\sqrt{-a}d}{\sqrt{b}}\right)\text{Si}\left(\frac{\sqrt{-a}d}{\sqrt{b}}-dx\right)}{4\sqrt{-a}b^{3/2}} + \frac{d\sin\left(c-\frac{\sqrt{-a}d}{\sqrt{b}}\right)\text{Si}\left(\frac{\sqrt{-a}d}{\sqrt{b}}+dx\right)}{4\sqrt{-a}b^{3/2}}\end{aligned}$$

output
```
-1/2*sin(d*x+c)/b/(b*x^2+a)-1/4*d*Ci(d*x+d*(-a)^(1/2)/b^(1/2))*cos(c-d*(-a
)^(1/2)/b^(1/2))/b^(3/2)/(-a)^(1/2)+1/4*d*Ci(-d*x+d*(-a)^(1/2)/b^(1/2))*co
s(c+d*(-a)^(1/2)/b^(1/2))/b^(3/2)/(-a)^(1/2)+1/4*d*Si(d*x+d*(-a)^(1/2)/b^(
1/2))*sin(c-d*(-a)^(1/2)/b^(1/2))/b^(3/2)/(-a)^(1/2)-1/4*d*Si(d*x-d*(-a)^(
1/2)/b^(1/2))*sin(c+d*(-a)^(1/2)/b^(1/2))/b^(3/2)/(-a)^(1/2)
```

### 3.68.2 Mathematica [C] (verified)

Result contains complex when optimal does not.

Time = 0.97 (sec) , antiderivative size = 236, normalized size of antiderivative = 0.99

$$\int \frac{x\sin(c+dx)}{(a+bx^2)^2}\,dx$$
$$= \frac{-\frac{ide^{-ic-\frac{\sqrt{a}d}{\sqrt{b}}}\left(e^{\frac{2\sqrt{a}d}{\sqrt{b}}}\text{ExpIntegralEi}\left(-\frac{\sqrt{a}d}{\sqrt{b}}-idx\right)-\text{ExpIntegralEi}\left(\frac{\sqrt{a}d}{\sqrt{b}}-idx\right)\right)}{\sqrt{a}}+\frac{ide^{ic-\frac{\sqrt{a}d}{\sqrt{b}}}\left(e^{\frac{2\sqrt{a}d}{\sqrt{b}}}\text{ExpIntegralEi}\left(-\frac{\sqrt{a}d}{\sqrt{b}}+idx\right)-\text{ExpIn}\right.}{\sqrt{a}}}{8b^{3/2}}$$

input
```
Integrate[(x*Sin[c + d*x])/(a + b*x^2)^2,x]
```

output
```
(((-I)*d*E^((-I)*c - (Sqrt[a]*d)/Sqrt[b])*(E^((2*Sqrt[a]*d)/Sqrt[b])*ExpIn
tegralEi[-((Sqrt[a]*d)/Sqrt[b]) - I*d*x] - ExpIntegralEi[(Sqrt[a]*d)/Sqrt[
b] - I*d*x]))/Sqrt[a] + (I*d*E^(I*c - (Sqrt[a]*d)/Sqrt[b])*(E^((2*Sqrt[a]*
d)/Sqrt[b])*ExpIntegralEi[-((Sqrt[a]*d)/Sqrt[b]) + I*d*x] - ExpIntegralEi[
(Sqrt[a]*d)/Sqrt[b] + I*d*x]))/Sqrt[a] - (4*Sqrt[b]*Cos[d*x]*Sin[c])/(a +
b*x^2) - (4*Sqrt[b]*Cos[c]*Sin[d*x])/(a + b*x^2))/(8*b^(3/2))
```

### 3.68.3 Rubi [A] (verified)

Time = 0.50 (sec) , antiderivative size = 244, normalized size of antiderivative = 1.02, number of steps used = 3, number of rules used = 3, $\frac{\text{number of rules}}{\text{integrand size}} = 0.176$, Rules used = {3822, 3815, 2009}

Below are the steps used by Rubi to obtain the solution. The rule number used for the transformation is given above next to the arrow. The rules definitions used are listed below.

$$\int \frac{x\sin(c+dx)}{(a+bx^2)^2}\,dx$$
$$\Big\downarrow \; 3822$$
$$\frac{d\int \frac{\cos(c+dx)}{bx^2+a}dx}{2b}-\frac{\sin(c+dx)}{2b\,(a+bx^2)}$$
$$\Big\downarrow \; 3815$$
$$\frac{d\int \left(\frac{\sqrt{-a}\cos(c+dx)}{2a\left(\sqrt{-a}-\sqrt{b}x\right)}+\frac{\sqrt{-a}\cos(c+dx)}{2a\left(\sqrt{b}x+\sqrt{-a}\right)}\right)dx}{2b}-\frac{\sin(c+dx)}{2b\,(a+bx^2)}$$

$$\Big\downarrow \text{2009}$$

$$\frac{d\left(\frac{\cos\left(\frac{\sqrt{-a}d}{\sqrt{b}}+c\right)\text{CosIntegral}\left(\frac{\sqrt{-a}d}{\sqrt{b}}-dx\right)}{2\sqrt{-a}\sqrt{b}}-\frac{\cos\left(c-\frac{\sqrt{-a}d}{\sqrt{b}}\right)\text{CosIntegral}\left(xd+\frac{\sqrt{-a}d}{\sqrt{b}}\right)}{2\sqrt{-a}\sqrt{b}}+\frac{\sin\left(\frac{\sqrt{-a}d}{\sqrt{b}}+c\right)\text{Si}\left(\frac{\sqrt{-a}d}{\sqrt{b}}-dx\right)}{2\sqrt{-a}\sqrt{b}}+\frac{\sin\left(c-\frac{\sqrt{-a}d}{\sqrt{b}}\right)\text{Si}}{2\sqrt{-a}}\right.}{2b}$$

$$\frac{\sin(c+dx)}{2b\left(a+bx^2\right)}$$

input
```
Int[(x*Sin[c + d*x])/(a + b*x^2)^2,x]
```

output
```
-1/2*Sin[c + d*x]/(b*(a + b*x^2)) + (d*((Cos[c + (Sqrt[-a]*d)/Sqrt[b]]*Cos
Integral[(Sqrt[-a]*d)/Sqrt[b] - d*x])/(2*Sqrt[-a]*Sqrt[b]) - (Cos[c - (Sqr
t[-a]*d)/Sqrt[b]]*CosIntegral[(Sqrt[-a]*d)/Sqrt[b] + d*x])/(2*Sqrt[-a]*Sqr
t[b]) + (Sin[c + (Sqrt[-a]*d)/Sqrt[b]]*SinIntegral[(Sqrt[-a]*d)/Sqrt[b] -
d*x])/(2*Sqrt[-a]*Sqrt[b]) + (Sin[c - (Sqrt[-a]*d)/Sqrt[b]]*SinIntegral[(S
qrt[-a]*d)/Sqrt[b] + d*x])/(2*Sqrt[-a]*Sqrt[b])))/(2*b)
```

### 3.68.3.1 Defintions of rubi rules used

rule 2009
```
Int[u_, x_Symbol] :> Simp[IntSum[u, x], x] /; SumQ[u]
```

rule 3815
```
Int[Cos[(c_.) + (d_.)*(x_)]*((a_) + (b_.)*(x_)^(n_))^(p_), x_Symbol] :> Int
[ExpandIntegrand[Cos[c + d*x], (a + b*x^n)^p, x], x] /; FreeQ[{a, b, c, d},
 x] && ILtQ[p, 0] && IGtQ[n, 0] && (EqQ[n, 2] || EqQ[p, -1])
```

rule 3822
```
Int[((e_.)*(x_))^(m_.)*((a_) + (b_.)*(x_)^(n_))^(p_)*Sin[(c_.) + (d_.)*(x_)
], x_Symbol] :> Simp[e^m*(a + b*x^n)^(p + 1)*(Sin[c + d*x]/(b*n*(p + 1))),
x] - Simp[d*(e^m/(b*n*(p + 1)))   Int[(a + b*x^n)^(p + 1)*Cos[c + d*x], x],
 x] /; FreeQ[{a, b, c, d, e, m, n}, x] && ILtQ[p, -1] && EqQ[m, n - 1] && (
IntegerQ[n] || GtQ[e, 0])
```

### 3.68.4 Maple [C] (verified)

Result contains complex when optimal does not.

Time = 0.43 (sec) , antiderivative size = 412, normalized size of antiderivative = 1.72

| method | result |
|---|---|
| risch | $-\frac{id\sqrt{ab}\,\mathrm{Ei}_1\left(\frac{icb+d\sqrt{ab}-b(idx+ic)}{b}\right)\mathrm{e}^{\frac{icb+d\sqrt{ab}}{b}}}{8a\,b^2}+\frac{id\sqrt{ab}\,\mathrm{e}^{\frac{icb-d\sqrt{ab}}{b}}\,\mathrm{Ei}_1\left(-\frac{-icb+d\sqrt{ab}+b(idx+ic)}{b}\right)}{8a\,b^2}-\frac{id\sqrt{ab}\,\mathrm{e}^{-\frac{icb+d\sqrt{}}{b}}}{}$ |
| derivativedivides | Expression too large to display |
| default | Expression too large to display |

input
```
int(x*sin(d*x+c)/(b*x^2+a)^2,x,method=_RETURNVERBOSE)
```

output
```
-1/8*I*d*(a*b)^(1/2)/a/b^2*Ei(1,(I*c*b+d*(a*b)^(1/2)-b*(I*d*x+I*c))/b)*exp
((I*c*b+d*(a*b)^(1/2))/b)+1/8*I*d*(a*b)^(1/2)/a/b^2*exp((I*c*b-d*(a*b)^(1/
2))/b)*Ei(1,-(-I*c*b+d*(a*b)^(1/2)+b*(I*d*x+I*c))/b)-1/8*I*d*(a*b)^(1/2)/a
/b^2*exp(-(I*c*b+d*(a*b)^(1/2))/b)*Ei(1,-(I*c*b+d*(a*b)^(1/2)-b*(I*d*x+I*c
))/b)+1/8*I*d*(a*b)^(1/2)/a/b^2*exp(-(I*c*b-d*(a*b)^(1/2))/b)*Ei(1,(-I*c*b
+d*(a*b)^(1/2)+b*(I*d*x+I*c))/b)-1/d^2*(1/2/(2*I*(I*d*x+I*c)*b*c-b*(I*d*x+
I*c)^2+a*d^2+c^2*b)/b/a*(I*(I*d*x+I*c)*b*c+a*d^2+c^2*b)*d^2-1/2*c*d^3*x/(-
2*I*(I*d*x+I*c)*b*c+b*(I*d*x+I*c)^2-a*d^2-c^2*b)/a)*sin(d*x+c)
```

### 3.68.5 Fricas [C] (verification not implemented)

Result contains complex when optimal does not.

Time = 0.30 (sec) , antiderivative size = 244, normalized size of antiderivative = 1.02

$$\int \frac{x\sin(c+dx)}{(a+bx^2)^2}\,dx$$
$$=\frac{(i\,bx^2+i\,a)\sqrt{\frac{ad^2}{b}}\mathrm{Ei}\left(i\,dx-\sqrt{\frac{ad^2}{b}}\right)e^{\left(i\,c+\sqrt{\frac{ad^2}{b}}\right)}+(-i\,bx^2-i\,a)\sqrt{\frac{ad^2}{b}}\mathrm{Ei}\left(i\,dx+\sqrt{\frac{ad^2}{b}}\right)e^{\left(i\,c-\sqrt{\frac{ad^2}{b}}\right)}+(-i}{8}$$

input
```
integrate(x*sin(d*x+c)/(b*x^2+a)^2,x, algorithm="fricas")
```

output
```
1/8*((I*b*x^2 + I*a)*sqrt(a*d^2/b)*Ei(I*d*x - sqrt(a*d^2/b))*e^(I*c + sqrt
(a*d^2/b)) + (-I*b*x^2 - I*a)*sqrt(a*d^2/b)*Ei(I*d*x + sqrt(a*d^2/b))*e^(I
*c - sqrt(a*d^2/b)) + (-I*b*x^2 - I*a)*sqrt(a*d^2/b)*Ei(-I*d*x - sqrt(a*d^
2/b))*e^(-I*c + sqrt(a*d^2/b)) + (I*b*x^2 + I*a)*sqrt(a*d^2/b)*Ei(-I*d*x +
 sqrt(a*d^2/b))*e^(-I*c - sqrt(a*d^2/b)) - 4*a*sin(d*x + c))/(a*b^2*x^2 +
a^2*b)
```

### 3.68.6 Sympy [F]

$$\int \frac{x\sin(c+dx)}{(a+bx^2)^2}\,dx = \int \frac{x\sin\left(c+dx\right)}{\left(a+bx^2\right)^2}\,dx$$

input
```
integrate(x*sin(d*x+c)/(b*x**2+a)**2,x)
```

output
```
Integral(x*sin(c + d*x)/(a + b*x**2)**2, x)
```

### 3.68.7 Maxima [F]

$$\int \frac{x\sin(c+dx)}{(a+bx^2)^2}\,dx = \int \frac{x\sin\left(dx+c\right)}{\left(bx^2+a\right)^2}\,dx$$

input
```
integrate(x*sin(d*x+c)/(b*x^2+a)^2,x, algorithm="maxima")
```

output
```
-1/2*((cos(c)^2 + sin(c)^2)*x*cos(d*x + c) + (x*cos(d*x + c)^2*cos(c) + x*
cos(c)*sin(d*x + c)^2)*cos(d*x + 2*c) + 2*(((b^2*cos(c)^2 + b^2*sin(c)^2)*
d*x^4 + 2*(a*b*cos(c)^2 + a*b*sin(c)^2)*d*x^2 + (a^2*cos(c)^2 + a^2*sin(c)
^2)*d)*cos(d*x + c)^2 + ((b^2*cos(c)^2 + b^2*sin(c)^2)*d*x^4 + 2*(a*b*cos(
c)^2 + a*b*sin(c)^2)*d*x^2 + (a^2*cos(c)^2 + a^2*sin(c)^2)*d)*sin(d*x + c)
^2)*integrate(1/2*(3*b*x^2 - a)*cos(d*x + c)/(b^3*d*x^6 + 3*a*b^2*d*x^4 +
3*a^2*b*d*x^2 + a^3*d), x) + 2*(((b^2*cos(c)^2 + b^2*sin(c)^2)*d*x^4 + 2*(
a*b*cos(c)^2 + a*b*sin(c)^2)*d*x^2 + (a^2*cos(c)^2 + a^2*sin(c)^2)*d)*cos(
d*x + c)^2 + ((b^2*cos(c)^2 + b^2*sin(c)^2)*d*x^4 + 2*(a*b*cos(c)^2 + a*b*
sin(c)^2)*d*x^2 + (a^2*cos(c)^2 + a^2*sin(c)^2)*d)*sin(d*x + c)^2)*integra
te(1/2*(3*b*x^2 - a)*cos(d*x + c)/((b^3*d*x^6 + 3*a*b^2*d*x^4 + 3*a^2*b*d*
x^2 + a^3*d)*cos(d*x + c)^2 + (b^3*d*x^6 + 3*a*b^2*d*x^4 + 3*a^2*b*d*x^2 +
 a^3*d)*sin(d*x + c)^2), x) + (x*cos(d*x + c)^2*sin(c) + x*sin(d*x + c)^2*
sin(c))*sin(d*x + 2*c))/(((b^2*cos(c)^2 + b^2*sin(c)^2)*d*x^4 + 2*(a*b*cos
(c)^2 + a*b*sin(c)^2)*d*x^2 + (a^2*cos(c)^2 + a^2*sin(c)^2)*d)*cos(d*x + c
)^2 + ((b^2*cos(c)^2 + b^2*sin(c)^2)*d*x^4 + 2*(a*b*cos(c)^2 + a*b*sin(c)^
2)*d*x^2 + (a^2*cos(c)^2 + a^2*sin(c)^2)*d)*sin(d*x + c)^2)
```

### 3.68.8 Giac [F]

$$\int \frac{x\sin(c+dx)}{(a+bx^2)^2}\,dx = \int \frac{x\sin(dx+c)}{(bx^2+a)^2}\,dx$$

input
```
integrate(x*sin(d*x+c)/(b*x^2+a)^2,x, algorithm="giac")
```

output
```
integrate(x*sin(d*x + c)/(b*x^2 + a)^2, x)
```

### 3.68.9 Mupad [F(-1)]

Timed out.

$$\int \frac{x\sin(c+dx)}{(a+bx^2)^2}\,dx = \int \frac{x\,\sin(c+d\,x)}{(b\,x^2+a)^2}\,dx$$

input
```
int((x*sin(c + d*x))/(a + b*x^2)^2,x)
```

output
```
int((x*sin(c + d*x))/(a + b*x^2)^2, x)
```

# 3.69 $\int \frac{\sin(c+dx)}{(a+bx^2)^2}\,dx$



## 3.69.1 Optimal result

Integrand size = 16, antiderivative size = 476

$$\begin{aligned}\int \frac{\sin(c+dx)}{(a+bx^2)^2}\,dx = &-\frac{d\cos\left(c+\frac{\sqrt{-a}d}{\sqrt{b}}\right)\text{CosIntegral}\left(\frac{\sqrt{-a}d}{\sqrt{b}}-dx\right)}{4ab}\\
&-\frac{d\cos\left(c-\frac{\sqrt{-a}d}{\sqrt{b}}\right)\text{CosIntegral}\left(\frac{\sqrt{-a}d}{\sqrt{b}}+dx\right)}{4ab}\\
&+\frac{\text{CosIntegral}\left(\frac{\sqrt{-a}d}{\sqrt{b}}+dx\right)\sin\left(c-\frac{\sqrt{-a}d}{\sqrt{b}}\right)}{4(-a)^{3/2}\sqrt{b}}\\
&-\frac{\text{CosIntegral}\left(\frac{\sqrt{-a}d}{\sqrt{b}}-dx\right)\sin\left(c+\frac{\sqrt{-a}d}{\sqrt{b}}\right)}{4(-a)^{3/2}\sqrt{b}}\\
&-\frac{\sin(c+dx)}{4a\sqrt{b}\left(\sqrt{-a}-\sqrt{b}x\right)}+\frac{\sin(c+dx)}{4a\sqrt{b}\left(\sqrt{-a}+\sqrt{b}x\right)}\\
&+\frac{\cos\left(c+\frac{\sqrt{-a}d}{\sqrt{b}}\right)\text{Si}\left(\frac{\sqrt{-a}d}{\sqrt{b}}-dx\right)}{4(-a)^{3/2}\sqrt{b}}-\frac{d\sin\left(c+\frac{\sqrt{-a}d}{\sqrt{b}}\right)\text{Si}\left(\frac{\sqrt{-a}d}{\sqrt{b}}-dx\right)}{4ab}\\
&+\frac{\cos\left(c-\frac{\sqrt{-a}d}{\sqrt{b}}\right)\text{Si}\left(\frac{\sqrt{-a}d}{\sqrt{b}}+dx\right)}{4(-a)^{3/2}\sqrt{b}}+\frac{d\sin\left(c-\frac{\sqrt{-a}d}{\sqrt{b}}\right)\text{Si}\left(\frac{\sqrt{-a}d}{\sqrt{b}}+dx\right)}{4ab}\end{aligned}$$

output
```
-1/4*d*Ci(d*x+d*(-a)^(1/2)/b^(1/2))*cos(c-d*(-a)^(1/2)/b^(1/2))/a/b-1/4*d*
Ci(-d*x+d*(-a)^(1/2)/b^(1/2))*cos(c+d*(-a)^(1/2)/b^(1/2))/a/b+1/4*d*Si(d*x
+d*(-a)^(1/2)/b^(1/2))*sin(c-d*(-a)^(1/2)/b^(1/2))/a/b+1/4*d*Si(d*x-d*(-a)
^(1/2)/b^(1/2))*sin(c+d*(-a)^(1/2)/b^(1/2))/a/b-1/4*cos(c+d*(-a)^(1/2)/b^(
1/2))*Si(d*x-d*(-a)^(1/2)/b^(1/2))/(-a)^(3/2)/b^(1/2)+1/4*cos(c-d*(-a)^(1/
2)/b^(1/2))*Si(d*x+d*(-a)^(1/2)/b^(1/2))/(-a)^(3/2)/b^(1/2)+1/4*Ci(d*x+d*(
-a)^(1/2)/b^(1/2))*sin(c-d*(-a)^(1/2)/b^(1/2))/(-a)^(3/2)/b^(1/2)-1/4*Ci(-
d*x+d*(-a)^(1/2)/b^(1/2))*sin(c+d*(-a)^(1/2)/b^(1/2))/(-a)^(3/2)/b^(1/2)-1
/4*sin(d*x+c)/a/b^(1/2)/((-a)^(1/2)-x*b^(1/2))+1/4*sin(d*x+c)/a/b^(1/2)/((
-a)^(1/2)+x*b^(1/2))
```

## 3.69.2 Mathematica [C] (verified)

Result contains complex when optimal does not.

Time = 1.95 (sec) , antiderivative size = 280, normalized size of antiderivative = 0.59

$$\int \frac{\sin(c+dx)}{(a+bx^2)^2}\,dx$$
$$= \frac{\frac{e^{-ic-\frac{\sqrt{a}d}{\sqrt{b}}}\left(\left(\sqrt{b}-\sqrt{a}d\right)e^{\frac{2\sqrt{a}d}{\sqrt{b}}}\operatorname{ExpIntegralEi}\left(-\frac{\sqrt{a}d}{\sqrt{b}}-idx\right)-\left(\sqrt{b}+\sqrt{a}d\right)\operatorname{ExpIntegralEi}\left(\frac{\sqrt{a}d}{\sqrt{b}}-idx\right)\right)}{b}+\frac{e^{ic-\frac{\sqrt{a}d}{\sqrt{b}}}\left(\left(\sqrt{b}-\sqrt{a}d\right)e^{\frac{2\sqrt{a}d}{\sqrt{b}}}\operatorname{ExpIn}\right.}{}}{8a^{3/2}}$$

input
```
Integrate[Sin[c + d*x]/(a + b*x^2)^2,x]
```

output
```
((E^((-I)*c - (Sqrt[a]*d)/Sqrt[b])*((Sqrt[b] - Sqrt[a]*d)*E^((2*Sqrt[a]*d)
/Sqrt[b])*ExpIntegralEi[-((Sqrt[a]*d)/Sqrt[b]) - I*d*x] - (Sqrt[b] + Sqrt[
a]*d)*ExpIntegralEi[(Sqrt[a]*d)/Sqrt[b] - I*d*x]))/b + (E^(I*c - (Sqrt[a]*
d)/Sqrt[b])*((Sqrt[b] - Sqrt[a]*d)*E^((2*Sqrt[a]*d)/Sqrt[b])*ExpIntegralEi
[-((Sqrt[a]*d)/Sqrt[b]) + I*d*x] - (Sqrt[b] + Sqrt[a]*d)*ExpIntegralEi[(Sq
rt[a]*d)/Sqrt[b] + I*d*x]))/b + (4*Sqrt[a]*x*Cos[d*x]*Sin[c])/(a + b*x^2)
+ (4*Sqrt[a]*x*Cos[c]*Sin[d*x])/(a + b*x^2))/(8*a^(3/2))
```

### 3.69.3 Rubi [A] (verified)

Time = 1.01 (sec) , antiderivative size = 476, normalized size of antiderivative = 1.00, number of steps used = 2, number of rules used = 2, $\frac{\text{number of rules}}{\text{integrand size}}$ = 0.125, Rules used = {3814, 2009}

Below are the steps used by Rubi to obtain the solution. The rule number used for the transformation is given above next to the arrow. The rules definitions used are listed below.

$$\int \frac{\sin(c+dx)}{(a+bx^2)^2}\,dx$$

$$\Big\downarrow \ 3814$$

$$\int \left(-\frac{b\sin(c+dx)}{2a(-ab-b^2x^2)}-\frac{b\sin(c+dx)}{4a\left(\sqrt{-a}\sqrt{b}-bx\right)^2}-\frac{b\sin(c+dx)}{4a\left(\sqrt{-a}\sqrt{b}+bx\right)^2}\right)dx$$

$$\Big\downarrow \ 2009$$

$$-\frac{\sin\left(\frac{\sqrt{-a}d}{\sqrt{b}}+c\right)\text{CosIntegral}\left(\frac{\sqrt{-a}d}{\sqrt{b}}-dx\right)}{4(-a)^{3/2}\sqrt{b}}+\frac{\sin\left(c-\frac{\sqrt{-a}d}{\sqrt{b}}\right)\text{CosIntegral}\left(xd+\frac{\sqrt{-a}d}{\sqrt{b}}\right)}{4(-a)^{3/2}\sqrt{b}}-\frac{d\cos\left(\frac{\sqrt{-a}d}{\sqrt{b}}+c\right)\text{CosIntegral}\left(\frac{\sqrt{-a}d}{\sqrt{b}}-dx\right)}{4ab}-\frac{d\cos\left(c-\frac{\sqrt{-a}d}{\sqrt{b}}\right)\text{CosIntegral}\left(xd+\frac{\sqrt{-a}d}{\sqrt{b}}\right)}{4ab}-\frac{d\sin\left(\frac{\sqrt{-a}d}{\sqrt{b}}+c\right)\text{Si}\left(\frac{\sqrt{-a}d}{\sqrt{b}}-dx\right)}{4ab}+\frac{d\sin\left(c-\frac{\sqrt{-a}d}{\sqrt{b}}\right)\text{Si}\left(xd+\frac{\sqrt{-a}d}{\sqrt{b}}\right)}{4ab}+\frac{\cos\left(\frac{\sqrt{-a}d}{\sqrt{b}}+c\right)\text{Si}\left(\frac{\sqrt{-a}d}{\sqrt{b}}-dx\right)}{4(-a)^{3/2}\sqrt{b}}+\frac{\cos\left(c-\frac{\sqrt{-a}d}{\sqrt{b}}\right)\text{Si}\left(xd+\frac{\sqrt{-a}d}{\sqrt{b}}\right)}{4(-a)^{3/2}\sqrt{b}}-\frac{\sin(c+dx)}{4a\sqrt{b}\left(\sqrt{-a}-\sqrt{b}x\right)}+\frac{\sin(c+dx)}{4a\sqrt{b}\left(\sqrt{-a}+\sqrt{b}x\right)}$$

input
```
Int[Sin[c + d*x]/(a + b*x^2)^2,x]
```

output
```
-1/4*(d*Cos[c + (Sqrt[-a]*d)/Sqrt[b]]*CosIntegral[(Sqrt[-a]*d)/Sqrt[b] - d
*x])/(a*b) - (d*Cos[c - (Sqrt[-a]*d)/Sqrt[b]]*CosIntegral[(Sqrt[-a]*d)/Sqr
t[b] + d*x])/(4*a*b) + (CosIntegral[(Sqrt[-a]*d)/Sqrt[b] + d*x]*Sin[c - (S
qrt[-a]*d)/Sqrt[b]])/(4*(-a)^(3/2)*Sqrt[b]) - (CosIntegral[(Sqrt[-a]*d)/Sq
rt[b] - d*x]*Sin[c + (Sqrt[-a]*d)/Sqrt[b]])/(4*(-a)^(3/2)*Sqrt[b]) - Sin[c
 + d*x]/(4*a*Sqrt[b]*(Sqrt[-a] - Sqrt[b]*x)) + Sin[c + d*x]/(4*a*Sqrt[b]*(
Sqrt[-a] + Sqrt[b]*x)) + (Cos[c + (Sqrt[-a]*d)/Sqrt[b]]*SinIntegral[(Sqrt[
-a]*d)/Sqrt[b] - d*x])/(4*(-a)^(3/2)*Sqrt[b]) - (d*Sin[c + (Sqrt[-a]*d)/Sq
rt[b]]*SinIntegral[(Sqrt[-a]*d)/Sqrt[b] - d*x])/(4*a*b) + (Cos[c - (Sqrt[-
a]*d)/Sqrt[b]]*SinIntegral[(Sqrt[-a]*d)/Sqrt[b] + d*x])/(4*(-a)^(3/2)*Sqrt
[b]) + (d*Sin[c - (Sqrt[-a]*d)/Sqrt[b]]*SinIntegral[(Sqrt[-a]*d)/Sqrt[b] +
 d*x])/(4*a*b)
```

#### 3.69.3.1 Defintions of rubi rules used

rule 2009
```
Int[u_, x_Symbol] :> Simp[IntSum[u, x], x] /; SumQ[u]
```

rule 3814
```
Int[((a_) + (b_.)*(x_)^(n_))^(p_)*Sin[(c_.) + (d_.)*(x_)], x_Symbol] :> Int
[ExpandIntegrand[Sin[c + d*x], (a + b*x^n)^p, x], x] /; FreeQ[{a, b, c, d},
 x] && ILtQ[p, 0] && IGtQ[n, 0] && (EqQ[n, 2] || EqQ[p, -1])
```

### 3.69.4 Maple [A] (verified)

Time = 0.35 (sec) , antiderivative size = 491, normalized size of antiderivative = 1.03

| method | result |
|---|---|
| derivativedivides | $d^{3}\left(\frac{\sin(dx+c)\left(\frac{dx+c}{2a\,d^{2}}-\frac{c}{2a\,d^{2}}\right)}{a\,d^{2}+c^{2}b-2bc(dx+c)+b(dx+c)^{2}}-\frac{\operatorname{Si}\left(dx+c-\frac{d\sqrt{-ab}+cb}{b}\right)\cos\left(\frac{d\sqrt{-ab}+cb}{b}\right)+\operatorname{Ci}\left(dx+c-\frac{d\sqrt{-ab}+cb}{b}\right)\sin\left(\frac{d\sqrt{-ab}+}{b}\right.}{4a\,d^{2}b\left(-\frac{d\sqrt{-ab}+cb}{b}+c\right)}\right.$ |
| default | $d^{3}\left(\frac{\sin(dx+c)\left(\frac{dx+c}{2a\,d^{2}}-\frac{c}{2a\,d^{2}}\right)}{a\,d^{2}+c^{2}b-2bc(dx+c)+b(dx+c)^{2}}-\frac{\operatorname{Si}\left(dx+c-\frac{d\sqrt{-ab}+cb}{b}\right)\cos\left(\frac{d\sqrt{-ab}+cb}{b}\right)+\operatorname{Ci}\left(dx+c-\frac{d\sqrt{-ab}+cb}{b}\right)\sin\left(\frac{d\sqrt{-ab}+}{b}\right.}{4a\,d^{2}b\left(-\frac{d\sqrt{-ab}+cb}{b}+c\right)}\right.$ |
| risch | $\frac{d\,{\mathrm e}^{\frac{icb+d\sqrt{ab}}{b}}\operatorname{Ei}_{1}\left(\frac{icb+d\sqrt{ab}-b(idx+ic)}{b}\right)}{8ab}+\frac{d\,{\mathrm e}^{\frac{icb-d\sqrt{ab}}{b}}\operatorname{Ei}_{1}\left(\frac{icb-d\sqrt{ab}-b(idx+ic)}{b}\right)}{8ab}-\frac{\sqrt{ab}\,{\mathrm e}^{\frac{icb+d\sqrt{ab}}{b}}\operatorname{Ei}_{1}\left(\frac{icb+d\sqrt{ab}-}{b}\right.}{8a^{2}b}$ |

input
```
int(sin(d*x+c)/(b*x^2+a)^2,x,method=_RETURNVERBOSE)
```

output
```
d^3*(sin(d*x+c)*(1/2/a/d^2*(d*x+c)-1/2*c/a/d^2)/(a*d^2+c^2*b-2*b*c*(d*x+c)
+b*(d*x+c)^2)-1/4/a/d^2/b/(-(d*(-a*b)^(1/2)+c*b)/b+c)*(Si(d*x+c-(d*(-a*b)^
(1/2)+c*b)/b)*cos((d*(-a*b)^(1/2)+c*b)/b)+Ci(d*x+c-(d*(-a*b)^(1/2)+c*b)/b)
*sin((d*(-a*b)^(1/2)+c*b)/b))-1/4/a/d^2/b/((d*(-a*b)^(1/2)-c*b)/b+c)*(Si(d
*x+c+(d*(-a*b)^(1/2)-c*b)/b)*cos((d*(-a*b)^(1/2)-c*b)/b)-Ci(d*x+c+(d*(-a*b
)^(1/2)-c*b)/b)*sin((d*(-a*b)^(1/2)-c*b)/b))-1/4/a/b/d^2*(-Si(d*x+c-(d*(-a
*b)^(1/2)+c*b)/b)*sin((d*(-a*b)^(1/2)+c*b)/b)+Ci(d*x+c-(d*(-a*b)^(1/2)+c*b
)/b)*cos((d*(-a*b)^(1/2)+c*b)/b))-1/4/a/b/d^2*(Si(d*x+c+(d*(-a*b)^(1/2)-c*
b)/b)*sin((d*(-a*b)^(1/2)-c*b)/b)+Ci(d*x+c+(d*(-a*b)^(1/2)-c*b)/b)*cos((d*
(-a*b)^(1/2)-c*b)/b)))
```

### 3.69.5 Fricas [C] (verification not implemented)

Result contains complex when optimal does not.

Time = 0.32 (sec) , antiderivative size = 333, normalized size of antiderivative = 0.70

$$\int \frac{\sin(c+dx)}{(a+bx^2)^2}\,dx$$
$$= \frac{4\,abdx\sin(dx+c) - \left(abd^2x^2 + a^2d^2 - (b^2x^2+ab)\sqrt{\frac{ad^2}{b}}\right)\mathrm{Ei}\left(i\,dx - \sqrt{\frac{ad^2}{b}}\right)e^{\left(i\,c+\sqrt{\frac{ad^2}{b}}\right)} - \left(abd^2x^2 + a^2\right.}{}$$

input
```
integrate(sin(d*x+c)/(b*x^2+a)^2,x, algorithm="fricas")
```

output
```
1/8*(4*a*b*d*x*sin(d*x + c) - (a*b*d^2*x^2 + a^2*d^2 - (b^2*x^2 + a*b)*sqr
t(a*d^2/b))*Ei(I*d*x - sqrt(a*d^2/b))*e^(I*c + sqrt(a*d^2/b)) - (a*b*d^2*x
^2 + a^2*d^2 + (b^2*x^2 + a*b)*sqrt(a*d^2/b))*Ei(I*d*x + sqrt(a*d^2/b))*e^
(I*c - sqrt(a*d^2/b)) - (a*b*d^2*x^2 + a^2*d^2 - (b^2*x^2 + a*b)*sqrt(a*d^
2/b))*Ei(-I*d*x - sqrt(a*d^2/b))*e^(-I*c + sqrt(a*d^2/b)) - (a*b*d^2*x^2 +
 a^2*d^2 + (b^2*x^2 + a*b)*sqrt(a*d^2/b))*Ei(-I*d*x + sqrt(a*d^2/b))*e^(-I
*c - sqrt(a*d^2/b)))/(a^2*b^2*d*x^2 + a^3*b*d)
```

### 3.69.6 Sympy [F]

$$\int \frac{\sin(c+dx)}{(a+bx^2)^2}\,dx = \int \frac{\sin(c+dx)}{(a+bx^2)^2}\,dx$$

input
```
integrate(sin(d*x+c)/(b*x**2+a)**2,x)
```

output
```
Integral(sin(c + d*x)/(a + b*x**2)**2, x)
```

### 3.69.7 Maxima [F]

$$\int \frac{\sin(c+dx)}{(a+bx^2)^2}\,dx = \int \frac{\sin(dx+c)}{(bx^2+a)^2}\,dx$$

input
```
integrate(sin(d*x+c)/(b*x^2+a)^2,x, algorithm="maxima")
```

output
```
integrate(sin(d*x + c)/(b*x^2 + a)^2, x)
```

### 3.69.8 Giac [F]

$$\int \frac{\sin(c+dx)}{(a+bx^2)^2}\,dx = \int \frac{\sin(dx+c)}{(bx^2+a)^2}\,dx$$

input
```
integrate(sin(d*x+c)/(b*x^2+a)^2,x, algorithm="giac")
```

output
```
integrate(sin(d*x + c)/(b*x^2 + a)^2, x)
```

### 3.69.9 Mupad [F(-1)]

Timed out.

$$\int \frac{\sin(c+dx)}{(a+bx^2)^2}\,dx = \int \frac{\sin\left(c+d\,x\right)}{\left(b\,x^2+a\right)^2}\,dx$$

input
```
int(sin(c + d*x)/(a + b*x^2)^2,x)
```

output
```
int(sin(c + d*x)/(a + b*x^2)^2, x)
```

# 3.70 $\int \frac{\sin(c+dx)}{x(a+bx^2)^2}\,dx$



## 3.70.1 Optimal result

Integrand size = 19, antiderivative size = 435

$$\begin{aligned}\int \frac{\sin(c+dx)}{x\,(a+bx^2)^2}\,dx = {} & \frac{d\cos\left(c+\frac{\sqrt{-a}d}{\sqrt{b}}\right)\operatorname{CosIntegral}\left(\frac{\sqrt{-a}d}{\sqrt{b}}-dx\right)}{4(-a)^{3/2}\sqrt{b}} \\ & -\frac{d\cos\left(c-\frac{\sqrt{-a}d}{\sqrt{b}}\right)\operatorname{CosIntegral}\left(\frac{\sqrt{-a}d}{\sqrt{b}}+dx\right)}{4(-a)^{3/2}\sqrt{b}} \\ & +\frac{\operatorname{CosIntegral}(dx)\sin(c)}{a^2}-\frac{\operatorname{CosIntegral}\left(\frac{\sqrt{-a}d}{\sqrt{b}}+dx\right)\sin\left(c-\frac{\sqrt{-a}d}{\sqrt{b}}\right)}{2a^2} \\ & -\frac{\operatorname{CosIntegral}\left(\frac{\sqrt{-a}d}{\sqrt{b}}-dx\right)\sin\left(c+\frac{\sqrt{-a}d}{\sqrt{b}}\right)}{2a^2}+\frac{\sin(c+dx)}{2a\,(a+bx^2)} \\ & +\frac{\cos(c)\operatorname{Si}(dx)}{a^2}+\frac{\cos\left(c+\frac{\sqrt{-a}d}{\sqrt{b}}\right)\operatorname{Si}\left(\frac{\sqrt{-a}d}{\sqrt{b}}-dx\right)}{2a^2} \\ & +\frac{d\sin\left(c+\frac{\sqrt{-a}d}{\sqrt{b}}\right)\operatorname{Si}\left(\frac{\sqrt{-a}d}{\sqrt{b}}-dx\right)}{4(-a)^{3/2}\sqrt{b}}-\frac{\cos\left(c-\frac{\sqrt{-a}d}{\sqrt{b}}\right)\operatorname{Si}\left(\frac{\sqrt{-a}d}{\sqrt{b}}+dx\right)}{2a^2} \\ & +\frac{d\sin\left(c-\frac{\sqrt{-a}d}{\sqrt{b}}\right)\operatorname{Si}\left(\frac{\sqrt{-a}d}{\sqrt{b}}+dx\right)}{4(-a)^{3/2}\sqrt{b}}\end{aligned}$$

output
```
cos(c)*Si(d*x)/a^2-1/2*cos(c+d*(-a)^(1/2)/b^(1/2))*Si(d*x-d*(-a)^(1/2)/b^(
1/2))/a^2-1/2*cos(c-d*(-a)^(1/2)/b^(1/2))*Si(d*x+d*(-a)^(1/2)/b^(1/2))/a^2
+Ci(d*x)*sin(c)/a^2+1/2*sin(d*x+c)/a/(b*x^2+a)-1/2*Ci(d*x+d*(-a)^(1/2)/b^(
1/2))*sin(c-d*(-a)^(1/2)/b^(1/2))/a^2-1/2*Ci(-d*x+d*(-a)^(1/2)/b^(1/2))*si
n(c+d*(-a)^(1/2)/b^(1/2))/a^2-1/4*d*Ci(d*x+d*(-a)^(1/2)/b^(1/2))*cos(c-d*(
-a)^(1/2)/b^(1/2))/(-a)^(3/2)/b^(1/2)+1/4*d*Ci(-d*x+d*(-a)^(1/2)/b^(1/2))*
cos(c+d*(-a)^(1/2)/b^(1/2))/(-a)^(3/2)/b^(1/2)+1/4*d*Si(d*x+d*(-a)^(1/2)/b
^(1/2))*sin(c-d*(-a)^(1/2)/b^(1/2))/(-a)^(3/2)/b^(1/2)-1/4*d*Si(d*x-d*(-a)
^(1/2)/b^(1/2))*sin(c+d*(-a)^(1/2)/b^(1/2))/(-a)^(3/2)/b^(1/2)
```

### 3.70.2 Mathematica [C] (verified)

Result contains complex when optimal does not.

Time = 0.95 (sec) , antiderivative size = 419, normalized size of antiderivative = 0.96

$$\int \frac{\sin(c+dx)}{x(a+bx^2)^2}\,dx$$
$$= \frac{\frac{i\sqrt{a}de^{-ic-\frac{\sqrt{a}d}{\sqrt{b}}}\left(e^{\frac{2\sqrt{a}d}{\sqrt{b}}}\text{ExpIntegralEi}\left(-\frac{\sqrt{a}d}{\sqrt{b}}-idx\right)-\text{ExpIntegralEi}\left(\frac{\sqrt{a}d}{\sqrt{b}}-idx\right)\right)}{\sqrt{b}}-2ie^{-ic-\frac{\sqrt{a}d}{\sqrt{b}}}\left(e^{\frac{2\sqrt{a}d}{\sqrt{b}}}\text{ExpIntegralEi}\left(-\frac{\sqrt{a}d}{\sqrt{b}}\right.\right.}{}$$

input
```
Integrate[Sin[c + d*x]/(x*(a + b*x^2)^2),x]
```

output
```
((I*Sqrt[a]*d*E^((-I)*c - (Sqrt[a]*d)/Sqrt[b])*(E^((2*Sqrt[a]*d)/Sqrt[b])*
ExpIntegralEi[-((Sqrt[a]*d)/Sqrt[b]) - I*d*x] - ExpIntegralEi[(Sqrt[a]*d)/
Sqrt[b] - I*d*x]))/Sqrt[b] - (2*I)*E^((-I)*c - (Sqrt[a]*d)/Sqrt[b])*(E^((2
*Sqrt[a]*d)/Sqrt[b])*ExpIntegralEi[-((Sqrt[a]*d)/Sqrt[b]) - I*d*x] + ExpIn
tegralEi[(Sqrt[a]*d)/Sqrt[b] - I*d*x]) - (I*Sqrt[a]*d*E^(I*c - (Sqrt[a]*d)
/Sqrt[b])*(E^((2*Sqrt[a]*d)/Sqrt[b])*ExpIntegralEi[-((Sqrt[a]*d)/Sqrt[b])
+ I*d*x] - ExpIntegralEi[(Sqrt[a]*d)/Sqrt[b] + I*d*x]))/Sqrt[b] + (2*I)*E^
(I*c - (Sqrt[a]*d)/Sqrt[b])*(E^((2*Sqrt[a]*d)/Sqrt[b])*ExpIntegralEi[-((Sq
rt[a]*d)/Sqrt[b]) + I*d*x] + ExpIntegralEi[(Sqrt[a]*d)/Sqrt[b] + I*d*x]) +
 (4*a*Cos[d*x]*Sin[c])/(a + b*x^2) + (4*a*Cos[c]*Sin[d*x])/(a + b*x^2) + 8
*(CosIntegral[d*x]*Sin[c] + Cos[c]*SinIntegral[d*x]))/(8*a^2)
```

### 3.70.3 Rubi [A] (verified)

Time = 0.99 (sec) , antiderivative size = 435, normalized size of antiderivative = 1.00, number of steps used = 2, number of rules used = 2, $\frac{\text{number of rules}}{\text{integrand size}}$ = 0.105, Rules used = {3826, 2009}

Below are the steps used by Rubi to obtain the solution. The rule number used for the transformation is given above next to the arrow. The rules definitions used are listed below.

$$\int \frac{\sin(c+dx)}{x\left(a+bx^2\right)^2}\,dx$$

$$\Big\downarrow \ 3826$$

$$\int \left(-\frac{bx\sin(c+dx)}{a^2\left(a+bx^2\right)}+\frac{\sin(c+dx)}{a^2x}-\frac{bx\sin(c+dx)}{a\left(a+bx^2\right)^2}\right)dx$$

$$\Big\downarrow \ 2009$$

$$-\frac{\sin\left(\frac{\sqrt{-a}d}{\sqrt{b}}+c\right)\text{CosIntegral}\left(\frac{\sqrt{-a}d}{\sqrt{b}}-dx\right)}{2a^2}-\frac{\sin\left(c-\frac{\sqrt{-a}d}{\sqrt{b}}\right)\text{CosIntegral}\left(xd+\frac{\sqrt{-a}d}{\sqrt{b}}\right)}{2a^2}+\frac{\cos\left(\frac{\sqrt{-a}d}{\sqrt{b}}+c\right)\text{Si}\left(\frac{\sqrt{-a}d}{\sqrt{b}}-dx\right)}{2a^2}-\frac{\cos\left(c-\frac{\sqrt{-a}d}{\sqrt{b}}\right)\text{Si}\left(xd+\frac{\sqrt{-a}d}{\sqrt{b}}\right)}{2a^2}+\frac{\sin(c)\text{CosIntegral}(dx)}{a^2}+\frac{\cos(c)\text{Si}(dx)}{a^2}+\frac{d\cos\left(\frac{\sqrt{-a}d}{\sqrt{b}}+c\right)\text{CosIntegral}\left(\frac{\sqrt{-a}d}{\sqrt{b}}-dx\right)}{4(-a)^{3/2}\sqrt{b}}-\frac{d\cos\left(c-\frac{\sqrt{-a}d}{\sqrt{b}}\right)\text{CosIntegral}\left(xd+\frac{\sqrt{-a}d}{\sqrt{b}}\right)}{4(-a)^{3/2}\sqrt{b}}+\frac{d\sin\left(\frac{\sqrt{-a}d}{\sqrt{b}}+c\right)\text{Si}\left(\frac{\sqrt{-a}d}{\sqrt{b}}-dx\right)}{4(-a)^{3/2}\sqrt{b}}+\frac{d\sin\left(c-\frac{\sqrt{-a}d}{\sqrt{b}}\right)\text{Si}\left(xd+\frac{\sqrt{-a}d}{\sqrt{b}}\right)}{4(-a)^{3/2}\sqrt{b}}+\frac{\sin(c+dx)}{2a\left(a+bx^2\right)}$$

input
```
Int[Sin[c + d*x]/(x*(a + b*x^2)^2),x]
```

output
```
(d*Cos[c + (Sqrt[-a]*d)/Sqrt[b]]*CosIntegral[(Sqrt[-a]*d)/Sqrt[b] - d*x])/
(4*(-a)^(3/2)*Sqrt[b]) - (d*Cos[c - (Sqrt[-a]*d)/Sqrt[b]]*CosIntegral[(Sqr
t[-a]*d)/Sqrt[b] + d*x])/(4*(-a)^(3/2)*Sqrt[b]) + (CosIntegral[d*x]*Sin[c]
)/a^2 - (CosIntegral[(Sqrt[-a]*d)/Sqrt[b] + d*x]*Sin[c - (Sqrt[-a]*d)/Sqrt
[b]])/(2*a^2) - (CosIntegral[(Sqrt[-a]*d)/Sqrt[b] - d*x]*Sin[c + (Sqrt[-a]
*d)/Sqrt[b]])/(2*a^2) + Sin[c + d*x]/(2*a*(a + b*x^2)) + (Cos[c]*SinIntegr
al[d*x])/a^2 + (Cos[c + (Sqrt[-a]*d)/Sqrt[b]]*SinIntegral[(Sqrt[-a]*d)/Sqr
t[b] - d*x])/(2*a^2) + (d*Sin[c + (Sqrt[-a]*d)/Sqrt[b]]*SinIntegral[(Sqrt[
-a]*d)/Sqrt[b] - d*x])/(4*(-a)^(3/2)*Sqrt[b]) - (Cos[c - (Sqrt[-a]*d)/Sqrt
[b]]*SinIntegral[(Sqrt[-a]*d)/Sqrt[b] + d*x])/(2*a^2) + (d*Sin[c - (Sqrt[-
a]*d)/Sqrt[b]]*SinIntegral[(Sqrt[-a]*d)/Sqrt[b] + d*x])/(4*(-a)^(3/2)*Sqrt
[b])
```

### 3.70.3.1 Defintions of rubi rules used

rule 2009
```
Int[u_, x_Symbol] :> Simp[IntSum[u, x], x] /; SumQ[u]
```

rule 3826
```
Int[(x_)^(m_.)*((a_) + (b_.)*(x_)^(n_))^(p_)*Sin[(c_.) + (d_.)*(x_)], x_Sym
bol] :> Int[ExpandIntegrand[Sin[c + d*x], x^m*(a + b*x^n)^p, x], x] /; Free
Q[{a, b, c, d, m}, x] && ILtQ[p, 0] && IGtQ[n, 0] && (EqQ[n, 2] || EqQ[p, -
1]) && IntegerQ[m]
```

## 3.70.4 Maple [A] (verified)

Time = 0.40 (sec) , antiderivative size = 478, normalized size of antiderivative = 1.10

| method | result |
|---|---|
| derivativedivides | $\frac{\sin(dx+c)d^2}{2a\left(a\,d^2+c^2b-2bc(dx+c)+b(dx+c)^2\right)}+\frac{\mathrm{Si}(dx)\cos(c)+\mathrm{Ci}(dx)\sin(c)}{a^2}-\frac{\mathrm{Si}\left(dx+c-\frac{d\sqrt{-ab}+cb}{b}\right)\cos\left(\frac{d\sqrt{-ab}+cb}{b}\right)+\mathrm{Ci}\left(\right.}{2a^2}$ |
| default | $\frac{\sin(dx+c)d^2}{2a\left(a\,d^2+c^2b-2bc(dx+c)+b(dx+c)^2\right)}+\frac{\mathrm{Si}(dx)\cos(c)+\mathrm{Ci}(dx)\sin(c)}{a^2}-\frac{\mathrm{Si}\left(dx+c-\frac{d\sqrt{-ab}+cb}{b}\right)\cos\left(\frac{d\sqrt{-ab}+cb}{b}\right)+\mathrm{Ci}\left(\right.}{2a^2}$ |
| risch | $\frac{i\mathrm{e}^{\frac{icb+d\sqrt{ab}}{b}}\,\mathrm{Ei}_1\left(\frac{icb+d\sqrt{ab}-b(idx+ic)}{b}\right)d}{8a\sqrt{ab}}-\frac{i\mathrm{e}^{\frac{icb-d\sqrt{ab}}{b}}\,\mathrm{Ei}_1\left(\frac{icb-d\sqrt{ab}-b(idx+ic)}{b}\right)d}{8a\sqrt{ab}}-\frac{i\mathrm{e}^{\frac{icb+d\sqrt{ab}}{b}}\,\mathrm{Ei}_1\left(\frac{icb+d\sqrt{ab}-b(id}{b}\right.}{4a^2}$ |

input
```
int(sin(d*x+c)/x/(b*x^2+a)^2,x,method=_RETURNVERBOSE)
```

output
```
1/2*sin(d*x+c)*d^2/a/(a*d^2+c^2*b-2*b*c*(d*x+c)+b*(d*x+c)^2)+1/a^2*(Si(d*x
)*cos(c)+Ci(d*x)*sin(c))-1/2/a^2*(Si(d*x+c-(d*(-a*b)^(1/2)+c*b)/b)*cos((d*
(-a*b)^(1/2)+c*b)/b)+Ci(d*x+c-(d*(-a*b)^(1/2)+c*b)/b)*sin((d*(-a*b)^(1/2)+
c*b)/b))-1/2/a^2*(Si(d*x+c+(d*(-a*b)^(1/2)-c*b)/b)*cos((d*(-a*b)^(1/2)-c*b
)/b)-Ci(d*x+c+(d*(-a*b)^(1/2)-c*b)/b)*sin((d*(-a*b)^(1/2)-c*b)/b))+1/4*d^2
/a/b/(-(d*(-a*b)^(1/2)+c*b)/b+c)*(-Si(d*x+c-(d*(-a*b)^(1/2)+c*b)/b)*sin((d
*(-a*b)^(1/2)+c*b)/b)+Ci(d*x+c-(d*(-a*b)^(1/2)+c*b)/b)*cos((d*(-a*b)^(1/2)
+c*b)/b))+1/4*d^2/a/b/((d*(-a*b)^(1/2)-c*b)/b+c)*(Si(d*x+c+(d*(-a*b)^(1/2)
-c*b)/b)*sin((d*(-a*b)^(1/2)-c*b)/b)+Ci(d*x+c+(d*(-a*b)^(1/2)-c*b)/b)*cos(
(d*(-a*b)^(1/2)-c*b)/b))
```

### 3.70.5 Fricas [C] (verification not implemented)

Result contains complex when optimal does not.

Time = 0.31 (sec) , antiderivative size = 320, normalized size of antiderivative = 0.74

$$\int \frac{\sin(c+dx)}{x\left(a+bx^2\right)^2}\,dx =$$

$$-\frac{\left(-2i\,bx^2-\left(-i\,bx^2-i\,a\right)\sqrt{\frac{ad^2}{b}}-2i\,a\right)\mathrm{Ei}\left(i\,dx-\sqrt{\frac{ad^2}{b}}\right)e^{\left(i\,c+\sqrt{\frac{ad^2}{b}}\right)}+\left(-2i\,bx^2-\left(i\,bx^2+i\,a\right)\sqrt{\frac{ad^2}{b}}\right.}{}$$

input
```
integrate(sin(d*x+c)/x/(b*x^2+a)^2,x, algorithm="fricas")
```

output
```
-1/8*((-2*I*b*x^2 - (-I*b*x^2 - I*a)*sqrt(a*d^2/b) - 2*I*a)*Ei(I*d*x - sqr
t(a*d^2/b))*e^(I*c + sqrt(a*d^2/b)) + (-2*I*b*x^2 - (I*b*x^2 + I*a)*sqrt(a
*d^2/b) - 2*I*a)*Ei(I*d*x + sqrt(a*d^2/b))*e^(I*c - sqrt(a*d^2/b)) + (2*I*
b*x^2 - (I*b*x^2 + I*a)*sqrt(a*d^2/b) + 2*I*a)*Ei(-I*d*x - sqrt(a*d^2/b))*
e^(-I*c + sqrt(a*d^2/b)) + (2*I*b*x^2 - (-I*b*x^2 - I*a)*sqrt(a*d^2/b) + 2
*I*a)*Ei(-I*d*x + sqrt(a*d^2/b))*e^(-I*c - sqrt(a*d^2/b)) - 8*(b*x^2 + a)*
cos_integral(d*x)*sin(c) - 8*(b*x^2 + a)*cos(c)*sin_integral(d*x) - 4*a*si
n(d*x + c))/(a^2*b*x^2 + a^3)
```

### 3.70.6 Sympy [F]

$$\int \frac{\sin(c+dx)}{x\left(a+bx^2\right)^2}\,dx = \int \frac{\sin\left(c+dx\right)}{x\left(a+bx^2\right)^2}\,dx$$

input
```
integrate(sin(d*x+c)/x/(b*x**2+a)**2,x)
```

output
```
Integral(sin(c + d*x)/(x*(a + b*x**2)**2), x)
```

### 3.70.7 Maxima [F]

$$\int \frac{\sin(c+dx)}{x\left(a+bx^2\right)^2}\,dx = \int \frac{\sin\left(dx+c\right)}{\left(bx^2+a\right)^2 x}\,dx$$

input
```
integrate(sin(d*x+c)/x/(b*x^2+a)^2,x, algorithm="maxima")
```

output
```
integrate(sin(d*x + c)/((b*x^2 + a)^2*x), x)
```

### 3.70.8 Giac [F]

$$\int \frac{\sin(c+dx)}{x\left(a+bx^2\right)^2}\,dx = \int \frac{\sin\left(dx+c\right)}{\left(bx^2+a\right)^2 x}\,dx$$

input
```
integrate(sin(d*x+c)/x/(b*x^2+a)^2,x, algorithm="giac")
```

output
```
integrate(sin(d*x + c)/((b*x^2 + a)^2*x), x)
```

### 3.70.9 Mupad [F(-1)]

Timed out.

$$\int \frac{\sin(c+dx)}{x(a+bx^2)^2}\,dx = \int \frac{\sin(c+d\,x)}{x\,(b\,x^2+a)^2}\,dx$$

input
```
int(sin(c + d*x)/(x*(a + b*x^2)^2),x)
```

output
```
int(sin(c + d*x)/(x*(a + b*x^2)^2), x)
```

# 3.71 $\int \frac{\sin(c+dx)}{x^2(a+bx^2)^2}\,dx$



## 3.71.1 Optimal result

Integrand size = 19, antiderivative size = 501

$$\begin{aligned}
\int \frac{\sin(c+dx)}{x^2(a+bx^2)^2}\,dx &= \frac{d\cos(c)\,\text{CosIntegral}(dx)}{a^2} + \frac{d\cos\left(c+\frac{\sqrt{-ad}}{\sqrt{b}}\right)\text{CosIntegral}\left(\frac{\sqrt{-ad}}{\sqrt{b}}-dx\right)}{4a^2} \\
&+ \frac{d\cos\left(c-\frac{\sqrt{-ad}}{\sqrt{b}}\right)\text{CosIntegral}\left(\frac{\sqrt{-ad}}{\sqrt{b}}+dx\right)}{4a^2} \\
&+ \frac{3\sqrt{b}\,\text{CosIntegral}\left(\frac{\sqrt{-ad}}{\sqrt{b}}+dx\right)\sin\left(c-\frac{\sqrt{-ad}}{\sqrt{b}}\right)}{4(-a)^{5/2}} \\
&- \frac{3\sqrt{b}\,\text{CosIntegral}\left(\frac{\sqrt{-ad}}{\sqrt{b}}-dx\right)\sin\left(c+\frac{\sqrt{-ad}}{\sqrt{b}}\right)}{4(-a)^{5/2}} \\
&- \frac{\sin(c+dx)}{a^2x} + \frac{\sqrt{b}\sin(c+dx)}{4a^2\left(\sqrt{-a}-\sqrt{b}x\right)} - \frac{\sqrt{b}\sin(c+dx)}{4a^2\left(\sqrt{-a}+\sqrt{b}x\right)} \\
&- \frac{d\sin(c)\text{Si}(dx)}{a^2} + \frac{3\sqrt{b}\cos\left(c+\frac{\sqrt{-ad}}{\sqrt{b}}\right)\text{Si}\left(\frac{\sqrt{-ad}}{\sqrt{b}}-dx\right)}{4(-a)^{5/2}} \\
&+ \frac{d\sin\left(c+\frac{\sqrt{-ad}}{\sqrt{b}}\right)\text{Si}\left(\frac{\sqrt{-ad}}{\sqrt{b}}-dx\right)}{4a^2} \\
&+ \frac{3\sqrt{b}\cos\left(c-\frac{\sqrt{-ad}}{\sqrt{b}}\right)\text{Si}\left(\frac{\sqrt{-ad}}{\sqrt{b}}+dx\right)}{4(-a)^{5/2}} \\
&- \frac{d\sin\left(c-\frac{\sqrt{-ad}}{\sqrt{b}}\right)\text{Si}\left(\frac{\sqrt{-ad}}{\sqrt{b}}+dx\right)}{4a^2}
\end{aligned}$$

output
```
d*Ci(d*x)*cos(c)/a^2+1/4*d*Ci(d*x+d*(-a)^(1/2)/b^(1/2))*cos(c-d*(-a)^(1/2)
/b^(1/2))/a^2+1/4*d*Ci(-d*x+d*(-a)^(1/2)/b^(1/2))*cos(c+d*(-a)^(1/2)/b^(1/
2))/a^2-d*Si(d*x)*sin(c)/a^2-sin(d*x+c)/a^2/x-1/4*d*Si(d*x+d*(-a)^(1/2)/b^
(1/2))*sin(c-d*(-a)^(1/2)/b^(1/2))/a^2-1/4*d*Si(d*x-d*(-a)^(1/2)/b^(1/2))*
sin(c+d*(-a)^(1/2)/b^(1/2))/a^2-3/4*cos(c+d*(-a)^(1/2)/b^(1/2))*Si(d*x-d*(
-a)^(1/2)/b^(1/2))*b^(1/2)/(-a)^(5/2)+3/4*cos(c-d*(-a)^(1/2)/b^(1/2))*Si(d
*x+d*(-a)^(1/2)/b^(1/2))*b^(1/2)/(-a)^(5/2)+3/4*Ci(d*x+d*(-a)^(1/2)/b^(1/2
))*sin(c-d*(-a)^(1/2)/b^(1/2))*b^(1/2)/(-a)^(5/2)-3/4*Ci(-d*x+d*(-a)^(1/2)
/b^(1/2))*sin(c+d*(-a)^(1/2)/b^(1/2))*b^(1/2)/(-a)^(5/2)+1/4*sin(d*x+c)*b^
(1/2)/a^2/((-a)^(1/2)-x*b^(1/2))-1/4*sin(d*x+c)*b^(1/2)/a^2/((-a)^(1/2)+x*
b^(1/2))
```

### 3.71.2 Mathematica [C] (verified)

Result contains complex when optimal does not.

Time = 2.30 (sec) , antiderivative size = 330, normalized size of antiderivative = 0.66

$$\int \frac{\sin(c+dx)}{x^2\left(a+bx^2\right)^2}\,dx$$
$$= \frac{e^{-ic-\frac{\sqrt{a}d}{\sqrt{b}}}\left(-\left(\left(3\sqrt{b}-\sqrt{a}d\right)e^{\frac{2\sqrt{a}d}{\sqrt{b}}}\text{ExpIntegralEi}\left(-\frac{\sqrt{a}d}{\sqrt{b}}-idx\right)\right)+\left(3\sqrt{b}+\sqrt{a}d\right)\text{ExpIntegralEi}\left(\frac{\sqrt{a}d}{\sqrt{b}}-\right.\right.}{}$$

input
```
Integrate[Sin[c + d*x]/(x^2*(a + b*x^2)^2),x]
```

output
```
(E^((-I)*c - (Sqrt[a]*d)/Sqrt[b])*(-((3*Sqrt[b] - Sqrt[a]*d)*E^((2*Sqrt[a]
*d)/Sqrt[b])*ExpIntegralEi[-((Sqrt[a]*d)/Sqrt[b]) - I*d*x]) + (3*Sqrt[b] +
 Sqrt[a]*d)*ExpIntegralEi[(Sqrt[a]*d)/Sqrt[b] - I*d*x]) + E^(I*c - (Sqrt[a
]*d)/Sqrt[b])*(-((3*Sqrt[b] - Sqrt[a]*d)*E^((2*Sqrt[a]*d)/Sqrt[b])*ExpInte
gralEi[-((Sqrt[a]*d)/Sqrt[b]) + I*d*x]) + (3*Sqrt[b] + Sqrt[a]*d)*ExpInteg
ralEi[(Sqrt[a]*d)/Sqrt[b] + I*d*x]) - (4*Sqrt[a]*(2*a + 3*b*x^2)*Cos[d*x]*
Sin[c])/(x*(a + b*x^2)) - (4*Sqrt[a]*(2*a + 3*b*x^2)*Cos[c]*Sin[d*x])/(x*(
a + b*x^2)) + 8*Sqrt[a]*d*(Cos[c]*CosIntegral[d*x] - Sin[c]*SinIntegral[d*
x]))/(8*a^(5/2))
```

### 3.71.3 Rubi [A] (verified)

Time = 1.36 (sec) , antiderivative size = 501, normalized size of antiderivative = 1.00, number of steps used = 2, number of rules used = 2, $\frac{\text{number of rules}}{\text{integrand size}}$ = 0.105, Rules used = {3826, 2009}

Below are the steps used by Rubi to obtain the solution. The rule number used for the transformation is given above next to the arrow. The rules definitions used are listed below.

$$\int \frac{\sin(c+dx)}{x^2\left(a+bx^2\right)^2}dx$$

$$\Big\downarrow \text{3826}$$

$$\int \left(-\frac{b\sin(c+dx)}{a^2\left(a+bx^2\right)}+\frac{\sin(c+dx)}{a^2x^2}-\frac{b\sin(c+dx)}{a\left(a+bx^2\right)^2}\right)dx$$

$$\Big\downarrow \text{2009}$$

$$\frac{d\cos\left(\frac{\sqrt{-a}d}{\sqrt{b}}+c\right)\text{CosIntegral}\left(\frac{\sqrt{-a}d}{\sqrt{b}}-dx\right)}{4a^2}+\frac{d\cos\left(c-\frac{\sqrt{-a}d}{\sqrt{b}}\right)\text{CosIntegral}\left(xd+\frac{\sqrt{-a}d}{\sqrt{b}}\right)}{4a^2}+\frac{d\sin\left(\frac{\sqrt{-a}d}{\sqrt{b}}+c\right)\text{Si}\left(\frac{\sqrt{-a}d}{\sqrt{b}}-dx\right)}{4a^2}-\frac{d\sin\left(c-\frac{\sqrt{-a}d}{\sqrt{b}}\right)\text{Si}\left(xd+\frac{\sqrt{-a}d}{\sqrt{b}}\right)}{4a^2}+\frac{\sqrt{b}\sin(c+dx)}{4a^2\left(\sqrt{-a}-\sqrt{b}x\right)}-\frac{\sqrt{b}\sin(c+dx)}{4a^2\left(\sqrt{-a}+\sqrt{b}x\right)}+\frac{d\cos(c)\text{CosIntegral}(dx)}{a^2}-\frac{d\sin(c)\text{Si}(dx)}{a^2}-\frac{\sin(c+dx)}{a^2x}+\frac{3\sqrt{b}\sin\left(c-\frac{\sqrt{-a}d}{\sqrt{b}}\right)\text{CosIntegral}\left(xd+\frac{\sqrt{-a}d}{\sqrt{b}}\right)}{4(-a)^{5/2}}-\frac{3\sqrt{b}\sin\left(\frac{\sqrt{-a}d}{\sqrt{b}}+c\right)\text{CosIntegral}\left(\frac{\sqrt{-a}d}{\sqrt{b}}-dx\right)}{4(-a)^{5/2}}+\frac{3\sqrt{b}\cos\left(\frac{\sqrt{-a}d}{\sqrt{b}}+c\right)\text{Si}\left(\frac{\sqrt{-a}d}{\sqrt{b}}-dx\right)}{4(-a)^{5/2}}+\frac{3\sqrt{b}\cos\left(c-\frac{\sqrt{-a}d}{\sqrt{b}}\right)\text{Si}\left(xd+\frac{\sqrt{-a}d}{\sqrt{b}}\right)}{4(-a)^{5/2}}$$

input
```
Int[Sin[c + d*x]/(x^2*(a + b*x^2)^2),x]
```

output
```
(d*Cos[c]*CosIntegral[d*x])/a^2 + (d*Cos[c + (Sqrt[-a]*d)/Sqrt[b]]*CosInte
gral[(Sqrt[-a]*d)/Sqrt[b] - d*x])/(4*a^2) + (d*Cos[c - (Sqrt[-a]*d)/Sqrt[b
]]*CosIntegral[(Sqrt[-a]*d)/Sqrt[b] + d*x])/(4*a^2) + (3*Sqrt[b]*CosIntegr
al[(Sqrt[-a]*d)/Sqrt[b] + d*x]*Sin[c - (Sqrt[-a]*d)/Sqrt[b]])/(4*(-a)^(5/2
)) - (3*Sqrt[b]*CosIntegral[(Sqrt[-a]*d)/Sqrt[b] - d*x]*Sin[c + (Sqrt[-a]*
d)/Sqrt[b]])/(4*(-a)^(5/2)) - Sin[c + d*x]/(a^2*x) + (Sqrt[b]*Sin[c + d*x]
)/(4*a^2*(Sqrt[-a] - Sqrt[b]*x)) - (Sqrt[b]*Sin[c + d*x])/(4*a^2*(Sqrt[-a]
 + Sqrt[b]*x)) - (d*Sin[c]*SinIntegral[d*x])/a^2 + (3*Sqrt[b]*Cos[c + (Sqr
t[-a]*d)/Sqrt[b]]*SinIntegral[(Sqrt[-a]*d)/Sqrt[b] - d*x])/(4*(-a)^(5/2))
+ (d*Sin[c + (Sqrt[-a]*d)/Sqrt[b]]*SinIntegral[(Sqrt[-a]*d)/Sqrt[b] - d*x]
)/(4*a^2) + (3*Sqrt[b]*Cos[c - (Sqrt[-a]*d)/Sqrt[b]]*SinIntegral[(Sqrt[-a]
*d)/Sqrt[b] + d*x])/(4*(-a)^(5/2)) - (d*Sin[c - (Sqrt[-a]*d)/Sqrt[b]]*SinI
ntegral[(Sqrt[-a]*d)/Sqrt[b] + d*x])/(4*a^2)
```

### 3.71.3.1 Defintions of rubi rules used

rule 2009
```
Int[u_, x_Symbol] :> Simp[IntSum[u, x], x] /; SumQ[u]
```

rule 3826
```
Int[(x_)^(m_.)*((a_) + (b_.)*(x_)^(n_))^(p_)*Sin[(c_.) + (d_.)*(x_)], x_Sym
bol] :> Int[ExpandIntegrand[Sin[c + d*x], x^m*(a + b*x^n)^p, x], x] /; Free
Q[{a, b, c, d, m}, x] && ILtQ[p, 0] && IGtQ[n, 0] && (EqQ[n, 2] || EqQ[p, -
1]) && IntegerQ[m]
```

## 3.71.4 Maple [C] (verified)

Result contains complex when optimal does not.

Time = 0.48 (sec) , antiderivative size = 622, normalized size of antiderivative = 1.24

| method | result |
|---|---|
| risch | $-\frac{d\,\mathrm{e}^{\frac{icb+d\sqrt{ab}}{b}}\,\mathrm{Ei}_1\left(\frac{icb+d\sqrt{ab}-b(idx+ic)}{b}\right)}{8a^2}-\frac{d\,\mathrm{e}^{\frac{icb-d\sqrt{ab}}{b}}\,\mathrm{Ei}_1\left(\frac{icb-d\sqrt{ab}-b(idx+ic)}{b}\right)}{8a^2}+\frac{3\,\mathrm{e}^{\frac{icb+d\sqrt{ab}}{b}}\,\mathrm{Ei}_1\left(\frac{icb+d\sqrt{ab}-b}{b}\right.}{8a^2\sqrt{ab}}$ |
| derivativedivides | $d\left(\frac{-\frac{\sin(dx+c)}{dx}-\mathrm{Si}(dx)\sin(c)+\mathrm{Ci}(dx)\cos(c)}{a^2}-\frac{b\left(-\frac{\mathrm{Si}\left(dx+c-\frac{d\sqrt{-ab}+cb}{b}\right)\cos\left(\frac{d\sqrt{-ab}+cb}{b}\right)+\mathrm{Ci}\left(dx+c-\frac{d\sqrt{-ab}+cb}{b}\right)\sin}{2b\left(-\frac{d\sqrt{-ab}+cb}{b}+c\right)}\right.}{}\right.$ |
| default | $d\left(\frac{-\frac{\sin(dx+c)}{dx}-\mathrm{Si}(dx)\sin(c)+\mathrm{Ci}(dx)\cos(c)}{a^2}-\frac{b\left(-\frac{\mathrm{Si}\left(dx+c-\frac{d\sqrt{-ab}+cb}{b}\right)\cos\left(\frac{d\sqrt{-ab}+cb}{b}\right)+\mathrm{Ci}\left(dx+c-\frac{d\sqrt{-ab}+cb}{b}\right)\sin}{2b\left(-\frac{d\sqrt{-ab}+cb}{b}+c\right)}\right.}{}\right.$ |

input
```
int(sin(d*x+c)/x^2/(b*x^2+a)^2,x,method=_RETURNVERBOSE)
```

output
```
-1/8*d/a^2*exp((I*c*b+d*(a*b)^(1/2))/b)*Ei(1,(I*c*b+d*(a*b)^(1/2)-b*(I*d*x
+I*c))/b)-1/8*d/a^2*exp((I*c*b-d*(a*b)^(1/2))/b)*Ei(1,(I*c*b-d*(a*b)^(1/2)
-b*(I*d*x+I*c))/b)+3/8/a^2/(a*b)^(1/2)*exp((I*c*b+d*(a*b)^(1/2))/b)*Ei(1,(
I*c*b+d*(a*b)^(1/2)-b*(I*d*x+I*c))/b)*b-3/8/a^2/(a*b)^(1/2)*exp((I*c*b-d*(
a*b)^(1/2))/b)*Ei(1,(I*c*b-d*(a*b)^(1/2)-b*(I*d*x+I*c))/b)*b-1/2*d/a^2*Ei(
1,-I*d*x)*exp(I*c)-1/8*d/a^2*exp(-(I*c*b-d*(a*b)^(1/2))/b)*Ei(1,-(I*c*b-d*
(a*b)^(1/2)-b*(I*d*x+I*c))/b)-1/8*d/a^2*exp(-(I*c*b+d*(a*b)^(1/2))/b)*Ei(1
,-(I*c*b+d*(a*b)^(1/2)-b*(I*d*x+I*c))/b)+3/8/a^2/(a*b)^(1/2)*exp(-(I*c*b-d
*(a*b)^(1/2))/b)*Ei(1,-(I*c*b-d*(a*b)^(1/2)-b*(I*d*x+I*c))/b)*b-3/8/a^2/(a
*b)^(1/2)*exp(-(I*c*b+d*(a*b)^(1/2))/b)*Ei(1,-(I*c*b+d*(a*b)^(1/2)-b*(I*d*
x+I*c))/b)*b-1/2*d/a^2*Ei(1,I*d*x)*exp(-I*c)-1/2*(6*I*(I*d*x+I*c)*b*c-3*b*
(I*d*x+I*c)^2+2*a*d^2+3*c^2*b)/a^2/(2*I*(I*d*x+I*c)*b*c-b*(I*d*x+I*c)^2+a*
d^2+c^2*b)/x*sin(d*x+c)
```

### 3.71.5 Fricas [C] (verification not implemented)

Result contains complex when optimal does not.

Time = 0.34 (sec) , antiderivative size = 400, normalized size of antiderivative = 0.80

$$\int \frac{\sin(c+dx)}{x^2\left(a+bx^2\right)^2}\,dx$$

$$=\frac{8\left(abd^2x^3+a^2d^2x\right)\cos(c)\,\mathrm{Ci}(dx)+\left(abd^2x^3+a^2d^2x-3\left(b^2x^3+abx\right)\sqrt{\frac{ad^2}{b}}\right)\mathrm{Ei}\left(i\,dx-\sqrt{\frac{ad^2}{b}}\right)e^{\left(ic+\sqrt{\frac{ad^2}{b}}\right.}}{}$$

input
```
integrate(sin(d*x+c)/x^2/(b*x^2+a)^2,x, algorithm="fricas")
```

output
```
1/8*(8*(a*b*d^2*x^3 + a^2*d^2*x)*cos(c)*cos_integral(d*x) + (a*b*d^2*x^3 +
 a^2*d^2*x - 3*(b^2*x^3 + a*b*x)*sqrt(a*d^2/b))*Ei(I*d*x - sqrt(a*d^2/b))*
e^(I*c + sqrt(a*d^2/b)) + (a*b*d^2*x^3 + a^2*d^2*x + 3*(b^2*x^3 + a*b*x)*s
qrt(a*d^2/b))*Ei(I*d*x + sqrt(a*d^2/b))*e^(I*c - sqrt(a*d^2/b)) + (a*b*d^2
*x^3 + a^2*d^2*x - 3*(b^2*x^3 + a*b*x)*sqrt(a*d^2/b))*Ei(-I*d*x - sqrt(a*d
^2/b))*e^(-I*c + sqrt(a*d^2/b)) + (a*b*d^2*x^3 + a^2*d^2*x + 3*(b^2*x^3 +
a*b*x)*sqrt(a*d^2/b))*Ei(-I*d*x + sqrt(a*d^2/b))*e^(-I*c - sqrt(a*d^2/b))
- 8*(a*b*d^2*x^3 + a^2*d^2*x)*sin(c)*sin_integral(d*x) - 4*(3*a*b*d*x^2 +
2*a^2*d)*sin(d*x + c))/(a^3*b*d*x^3 + a^4*d*x)
```

### 3.71.6 Sympy [F]

$$\int \frac{\sin(c+dx)}{x^2\left(a+bx^2\right)^2}\,dx = \int \frac{\sin\left(c+dx\right)}{x^2\left(a+bx^2\right)^2}\,dx$$

input
```
integrate(sin(d*x+c)/x**2/(b*x**2+a)**2,x)
```

output
```
Integral(sin(c + d*x)/(x**2*(a + b*x**2)**2), x)
```

### 3.71.7 Maxima [F]

$$\int \frac{\sin(c+dx)}{x^2\left(a+bx^2\right)^2}\,dx = \int \frac{\sin\left(dx+c\right)}{\left(bx^2+a\right)^2x^2}\,dx$$

input
```
integrate(sin(d*x+c)/x^2/(b*x^2+a)^2,x, algorithm="maxima")
```

output
```
integrate(sin(d*x + c)/((b*x^2 + a)^2*x^2), x)
```

### 3.71.8 Giac [F]

$$\int \frac{\sin(c+dx)}{x^2\left(a+bx^2\right)^2}\,dx = \int \frac{\sin\left(dx+c\right)}{\left(bx^2+a\right)^2x^2}\,dx$$

input
```
integrate(sin(d*x+c)/x^2/(b*x^2+a)^2,x, algorithm="giac")
```

output
```
integrate(sin(d*x + c)/((b*x^2 + a)^2*x^2), x)
```

### 3.71.9 Mupad [F(-1)]

Timed out.

$$\int \frac{\sin(c+dx)}{x^2\left(a+bx^2\right)^2}\,dx = \int \frac{\sin\left(c+d\,x\right)}{x^2\,\left(b\,x^2+a\right)^2}\,dx$$

input
```
int(sin(c + d*x)/(x^2*(a + b*x^2)^2),x)
```

output
```
int(sin(c + d*x)/(x^2*(a + b*x^2)^2), x)
```

# 3.72 $\int \frac{x^3\sin(c+dx)}{(a+bx^2)^3}\,dx$



## 3.72.1 Optimal result

Integrand size = 19, antiderivative size = 476

$$\begin{aligned}\int \frac{x^3\sin(c+dx)}{(a+bx^2)^3}\,dx = &-\frac{dx\cos(c+dx)}{8b^2(a+bx^2)}+\frac{3d\cos\left(c+\frac{\sqrt{-a}d}{\sqrt{b}}\right)\text{CosIntegral}\left(\frac{\sqrt{-a}d}{\sqrt{b}}-dx\right)}{16\sqrt{-a}b^{5/2}}\\
&-\frac{3d\cos\left(c-\frac{\sqrt{-a}d}{\sqrt{b}}\right)\text{CosIntegral}\left(\frac{\sqrt{-a}d}{\sqrt{b}}+dx\right)}{16\sqrt{-a}b^{5/2}}\\
&-\frac{d^2\,\text{CosIntegral}\left(\frac{\sqrt{-a}d}{\sqrt{b}}+dx\right)\sin\left(c-\frac{\sqrt{-a}d}{\sqrt{b}}\right)}{16b^3}\\
&-\frac{d^2\,\text{CosIntegral}\left(\frac{\sqrt{-a}d}{\sqrt{b}}-dx\right)\sin\left(c+\frac{\sqrt{-a}d}{\sqrt{b}}\right)}{16b^3}-\frac{x^2\sin(c+dx)}{4b(a+bx^2)^2}\\
&-\frac{\sin(c+dx)}{4b^2(a+bx^2)}+\frac{d^2\cos\left(c+\frac{\sqrt{-a}d}{\sqrt{b}}\right)\text{Si}\left(\frac{\sqrt{-a}d}{\sqrt{b}}-dx\right)}{16b^3}\\
&+\frac{3d\sin\left(c+\frac{\sqrt{-a}d}{\sqrt{b}}\right)\text{Si}\left(\frac{\sqrt{-a}d}{\sqrt{b}}-dx\right)}{16\sqrt{-a}b^{5/2}}\\
&-\frac{d^2\cos\left(c-\frac{\sqrt{-a}d}{\sqrt{b}}\right)\text{Si}\left(\frac{\sqrt{-a}d}{\sqrt{b}}+dx\right)}{16b^3}\\
&+\frac{3d\sin\left(c-\frac{\sqrt{-a}d}{\sqrt{b}}\right)\text{Si}\left(\frac{\sqrt{-a}d}{\sqrt{b}}+dx\right)}{16\sqrt{-a}b^{5/2}}\end{aligned}$$

output
```
-1/8*d*x*cos(d*x+c)/b^2/(b*x^2+a)-1/16*d^2*cos(c+d*(-a)^(1/2)/b^(1/2))*Si(
d*x-d*(-a)^(1/2)/b^(1/2))/b^3-1/16*d^2*cos(c-d*(-a)^(1/2)/b^(1/2))*Si(d*x+
d*(-a)^(1/2)/b^(1/2))/b^3-1/4*x^2*sin(d*x+c)/b/(b*x^2+a)^2-1/4*sin(d*x+c)/
b^2/(b*x^2+a)-1/16*d^2*Ci(d*x+d*(-a)^(1/2)/b^(1/2))*sin(c-d*(-a)^(1/2)/b^(
1/2))/b^3-1/16*d^2*Ci(-d*x+d*(-a)^(1/2)/b^(1/2))*sin(c+d*(-a)^(1/2)/b^(1/2
))/b^3-3/16*d*Ci(d*x+d*(-a)^(1/2)/b^(1/2))*cos(c-d*(-a)^(1/2)/b^(1/2))/b^(
5/2)/(-a)^(1/2)+3/16*d*Ci(-d*x+d*(-a)^(1/2)/b^(1/2))*cos(c+d*(-a)^(1/2)/b^
(1/2))/b^(5/2)/(-a)^(1/2)+3/16*d*Si(d*x+d*(-a)^(1/2)/b^(1/2))*sin(c-d*(-a)
^(1/2)/b^(1/2))/b^(5/2)/(-a)^(1/2)-3/16*d*Si(d*x-d*(-a)^(1/2)/b^(1/2))*sin
(c+d*(-a)^(1/2)/b^(1/2))/b^(5/2)/(-a)^(1/2)
```

### 3.72.2 Mathematica [C] (verified)

Result contains complex when optimal does not.

Time = 2.48 (sec) , antiderivative size = 330, normalized size of antiderivative = 0.69

$$\int \frac{x^3 \sin(c+dx)}{(a+bx^2)^3}\,dx$$

$$= \frac{-\frac{ide^{-ic-\frac{\sqrt{a}d}{\sqrt{b}}}\left(\left(3\sqrt{b}+\sqrt{a}d\right)e^{\frac{2\sqrt{a}d}{\sqrt{b}}}\operatorname{ExpIntegralEi}\left(-\frac{\sqrt{a}d}{\sqrt{b}}-idx\right)+\left(-3\sqrt{b}+\sqrt{a}d\right)\operatorname{ExpIntegralEi}\left(\frac{\sqrt{a}d}{\sqrt{b}}-idx\right)\right)}{\sqrt{a}}+\frac{ide^{ic-\frac{\sqrt{a}d}{\sqrt{b}}}\left(\left(3\sqrt{b}+\sqrt{a}d\right)e}{}}{}$$

input
```
Integrate[(x^3*Sin[c + d*x])/(a + b*x^2)^3,x]
```

output
```
(((-I)*d*E^((-I)*c - (Sqrt[a]*d)/Sqrt[b])*((3*Sqrt[b] + Sqrt[a]*d)*E^((2*S
qrt[a]*d)/Sqrt[b])*ExpIntegralEi[-((Sqrt[a]*d)/Sqrt[b]) - I*d*x] + (-3*Sqr
t[b] + Sqrt[a]*d)*ExpIntegralEi[(Sqrt[a]*d)/Sqrt[b] - I*d*x]))/Sqrt[a] + (
I*d*E^(I*c - (Sqrt[a]*d)/Sqrt[b])*((3*Sqrt[b] + Sqrt[a]*d)*E^((2*Sqrt[a]*d
)/Sqrt[b])*ExpIntegralEi[-((Sqrt[a]*d)/Sqrt[b]) + I*d*x] + (-3*Sqrt[b] + S
qrt[a]*d)*ExpIntegralEi[(Sqrt[a]*d)/Sqrt[b] + I*d*x]))/Sqrt[a] - (4*b*Cos[
d*x]*(d*x*(a + b*x^2)*Cos[c] + 2*(a + 2*b*x^2)*Sin[c]))/(a + b*x^2)^2 + (4
*b*(-2*(a + 2*b*x^2)*Cos[c] + d*x*(a + b*x^2)*Sin[c])*Sin[d*x])/(a + b*x^2
)^2)/(32*b^3)
```

### 3.72.3 Rubi [A] (verified)

Time = 1.81 (sec) , antiderivative size = 714, normalized size of antiderivative = 1.50, number of steps used = 9, number of rules used = 9, $\frac{\text{number of rules}}{\text{integrand size}} = 0.474$, Rules used = {3824, 3822, 3815, 2009, 3825, 3815, 2009, 3826, 2009}

Below are the steps used by Rubi to obtain the solution. The rule number used for the transformation is given above next to the arrow. The rules definitions used are listed below.

$$\int \frac{x^3 \sin(c+dx)}{(a+bx^2)^3}\,dx$$

$$\Big\downarrow \text{3824}$$

$$\frac{\int \frac{x\sin(c+dx)}{(bx^2+a)^2}dx}{2b}+\frac{d\int \frac{x^2\cos(c+dx)}{(bx^2+a)^2}dx}{4b}-\frac{x^2\sin(c+dx)}{4b\,(a+bx^2)^2}$$

$$\Big\downarrow \text{3822}$$

$$\frac{d\int \frac{x^2\cos(c+dx)}{(bx^2+a)^2}dx}{4b}+\frac{\frac{d\int \frac{\cos(c+dx)}{bx^2+a}dx}{2b}-\frac{\sin(c+dx)}{2b(a+bx^2)}}{2b}-\frac{x^2\sin(c+dx)}{4b\,(a+bx^2)^2}$$

$$\Big\downarrow \text{3815}$$

$$\frac{d\int \frac{x^2\cos(c+dx)}{(bx^2+a)^2}dx}{4b}+\frac{\frac{d\int \left(\frac{\sqrt{-a}\cos(c+dx)}{2a\left(\sqrt{-a}-\sqrt{b}x\right)}+\frac{\sqrt{-a}\cos(c+dx)}{2a\left(\sqrt{b}x+\sqrt{-a}\right)}\right)dx}{2b}-\frac{\sin(c+dx)}{2b(a+bx^2)}}{2b}-\frac{x^2\sin(c+dx)}{4b\,(a+bx^2)^2}$$

$$\Big\downarrow \text{2009}$$

$$\frac{d\int \frac{x^2\cos(c+dx)}{(bx^2+a)^2}dx}{4b}+\frac{\frac{d\left(\frac{\cos\left(\frac{\sqrt{-a}d}{\sqrt{b}}+c\right)\text{CosIntegral}\left(\frac{\sqrt{-a}d}{\sqrt{b}}-dx\right)}{2\sqrt{-a}\sqrt{b}}-\frac{\cos\left(c-\frac{\sqrt{-a}d}{\sqrt{b}}\right)\text{CosIntegral}\left(xd+\frac{\sqrt{-a}d}{\sqrt{b}}\right)}{2\sqrt{-a}\sqrt{b}}+\frac{\sin\left(\frac{\sqrt{-a}d}{\sqrt{b}}+c\right)\text{Si}\left(\frac{\sqrt{-a}d}{\sqrt{b}}-dx\right)}{2\sqrt{-a}\sqrt{b}}+\frac{\sin\left(c-\frac{\sqrt{-a}d}{\sqrt{b}}\right)\text{Si}\left(xd+\frac{\sqrt{-a}d}{\sqrt{b}}\right)}{2\sqrt{-a}\sqrt{b}}\right)}{2b}}{2b}$$

$$\frac{x^2\sin(c+dx)}{4b\,(a+bx^2)^2}$$

$$\Big\downarrow \text{3825}$$

$$\frac{d\left(-\frac{d\int \frac{x\sin(c+dx)}{bx^2+a}dx}{2b}+\frac{\int \frac{\cos(c+dx)}{bx^2+a}dx}{2b}-\frac{x\cos(c+dx)}{2b(a+bx^2)}\right)}{4b}+$$

$$\frac{\frac{d\left(\frac{\cos\left(\frac{\sqrt{-a}d}{\sqrt{b}}+c\right)\text{CosIntegral}\left(\frac{\sqrt{-a}d}{\sqrt{b}}-dx\right)}{2\sqrt{-a}\sqrt{b}}-\frac{\cos\left(c-\frac{\sqrt{-a}d}{\sqrt{b}}\right)\text{CosIntegral}\left(xd+\frac{\sqrt{-a}d}{\sqrt{b}}\right)}{2\sqrt{-a}\sqrt{b}}+\frac{\sin\left(\frac{\sqrt{-a}d}{\sqrt{b}}+c\right)\text{Si}\left(\frac{\sqrt{-a}d}{\sqrt{b}}-dx\right)}{2\sqrt{-a}\sqrt{b}}+\frac{\sin\left(c-\frac{\sqrt{-a}d}{\sqrt{b}}\right)\text{Si}\left(xd+\frac{\sqrt{-a}d}{\sqrt{b}}\right)}{2\sqrt{-a}\sqrt{b}}\right)}{2b}}{2b}$$

$$\frac{x^2\sin(c+dx)}{4b\left(a+bx^2\right)^2}$$

$$\downarrow \text{3815}$$

$$\frac{d\left(-\frac{d\int \frac{x\sin(c+dx)}{bx^2+a}dx}{2b}+\frac{\int\left(\frac{\sqrt{-a}\cos(c+dx)}{2a\left(\sqrt{-a}-\sqrt{b}x\right)}+\frac{\sqrt{-a}\cos(c+dx)}{2a\left(\sqrt{b}x+\sqrt{-a}\right)}\right)dx}{2b}-\frac{x\cos(c+dx)}{2b(a+bx^2)}\right)}{4b}+$$

$$\frac{\frac{d\left(\frac{\cos\left(\frac{\sqrt{-a}d}{\sqrt{b}}+c\right)\text{CosIntegral}\left(\frac{\sqrt{-a}d}{\sqrt{b}}-dx\right)}{2\sqrt{-a}\sqrt{b}}-\frac{\cos\left(c-\frac{\sqrt{-a}d}{\sqrt{b}}\right)\text{CosIntegral}\left(xd+\frac{\sqrt{-a}d}{\sqrt{b}}\right)}{2\sqrt{-a}\sqrt{b}}+\frac{\sin\left(\frac{\sqrt{-a}d}{\sqrt{b}}+c\right)\text{Si}\left(\frac{\sqrt{-a}d}{\sqrt{b}}-dx\right)}{2\sqrt{-a}\sqrt{b}}+\frac{\sin\left(c-\frac{\sqrt{-a}d}{\sqrt{b}}\right)\text{Si}\left(xd+\frac{\sqrt{-a}d}{\sqrt{b}}\right)}{2\sqrt{-a}\sqrt{b}}\right)}{2b}}{2b}$$

$$\frac{x^2\sin(c+dx)}{4b\left(a+bx^2\right)^2}$$

$$\downarrow \text{2009}$$

$$\frac{d\left(-\frac{d\int \frac{x\sin(c+dx)}{bx^2+a}dx}{2b}+\frac{\frac{\cos\left(\frac{\sqrt{-a}d}{\sqrt{b}}+c\right)\text{CosIntegral}\left(\frac{\sqrt{-a}d}{\sqrt{b}}-dx\right)}{2\sqrt{-a}\sqrt{b}}-\frac{\cos\left(c-\frac{\sqrt{-a}d}{\sqrt{b}}\right)\text{CosIntegral}\left(xd+\frac{\sqrt{-a}d}{\sqrt{b}}\right)}{2\sqrt{-a}\sqrt{b}}+\frac{\sin\left(\frac{\sqrt{-a}d}{\sqrt{b}}+c\right)\text{Si}\left(\frac{\sqrt{-a}d}{\sqrt{b}}-dx\right)}{2\sqrt{-a}\sqrt{b}}+\frac{\sin(c-}{}}{2b}\right.}{4b}$$

$$\frac{\frac{d\left(\frac{\cos\left(\frac{\sqrt{-a}d}{\sqrt{b}}+c\right)\text{CosIntegral}\left(\frac{\sqrt{-a}d}{\sqrt{b}}-dx\right)}{2\sqrt{-a}\sqrt{b}}-\frac{\cos\left(c-\frac{\sqrt{-a}d}{\sqrt{b}}\right)\text{CosIntegral}\left(xd+\frac{\sqrt{-a}d}{\sqrt{b}}\right)}{2\sqrt{-a}\sqrt{b}}+\frac{\sin\left(\frac{\sqrt{-a}d}{\sqrt{b}}+c\right)\text{Si}\left(\frac{\sqrt{-a}d}{\sqrt{b}}-dx\right)}{2\sqrt{-a}\sqrt{b}}+\frac{\sin\left(c-\frac{\sqrt{-a}d}{\sqrt{b}}\right)\text{Si}\left(xd+\frac{\sqrt{-a}d}{\sqrt{b}}\right)}{2\sqrt{-a}\sqrt{b}}\right)}{2b}}{2b}$$

$$\frac{x^2\sin(c+dx)}{4b\left(a+bx^2\right)^2}$$

$$\downarrow \text{3826}$$

---

3.72. $\int \frac{x^3\sin(c+dx)}{\left(a+bx^2\right)^3}\,dx$

$$d\left(-\frac{d\int \left(\frac{\sin(c+dx)}{2\sqrt{b}\left(\sqrt{b}x+\sqrt{-a}\right)}-\frac{\sin(c+dx)}{2\sqrt{b}\left(\sqrt{-a}-\sqrt{b}x\right)}\right)dx}{2b}+\frac{\frac{\cos\left(\frac{\sqrt{-a}d}{\sqrt{b}}+c\right)\text{CosIntegral}\left(\frac{\sqrt{-a}d}{\sqrt{b}}-dx\right)}{2\sqrt{-a}\sqrt{b}}-\frac{\cos\left(c-\frac{\sqrt{-a}d}{\sqrt{b}}\right)\text{CosIntegral}\left(xd+\frac{\sqrt{-a}d}{\sqrt{b}}\right)}{2\sqrt{-a}\sqrt{b}}+\sin\left(\frac{\sqrt{-a}d}{\sqrt{b}}+ \cdots\right.}{2b}\right.$$

$$4b$$

$$\frac{d\left(\frac{\cos\left(\frac{\sqrt{-a}d}{\sqrt{b}}+c\right)\text{CosIntegral}\left(\frac{\sqrt{-a}d}{\sqrt{b}}-dx\right)}{2\sqrt{-a}\sqrt{b}}-\frac{\cos\left(c-\frac{\sqrt{-a}d}{\sqrt{b}}\right)\text{CosIntegral}\left(xd+\frac{\sqrt{-a}d}{\sqrt{b}}\right)}{2\sqrt{-a}\sqrt{b}}+\frac{\sin\left(\frac{\sqrt{-a}d}{\sqrt{b}}+c\right)\text{Si}\left(\frac{\sqrt{-a}d}{\sqrt{b}}-dx\right)}{2\sqrt{-a}\sqrt{b}}+\frac{\sin\left(c-\frac{\sqrt{-a}d}{\sqrt{b}}\right)\text{Si}\left(xd+\frac{\sqrt{-a}d}{\sqrt{b}}\right)}{2\sqrt{-a}\sqrt{b}}\right)}{2b}$$

$$2b$$

$$\frac{x^2\sin(c+dx)}{4b\left(a+bx^2\right)^2}$$

$$\Big\downarrow \text{2009}$$

$$d\left(-\frac{d\left(\frac{\sin\left(c-\frac{\sqrt{-a}d}{\sqrt{b}}\right)\text{CosIntegral}\left(xd+\frac{\sqrt{-a}d}{\sqrt{b}}\right)}{2b}+\frac{\sin\left(\frac{\sqrt{-a}d}{\sqrt{b}}+c\right)\text{CosIntegral}\left(\frac{\sqrt{-a}d}{\sqrt{b}}-dx\right)}{2b}-\frac{\cos\left(\frac{\sqrt{-a}d}{\sqrt{b}}+c\right)\text{Si}\left(\frac{\sqrt{-a}d}{\sqrt{b}}-dx\right)}{2b}+\frac{\cos\left(c-\frac{\sqrt{-a}d}{\sqrt{b}}\right)\text{Si}\left(xd+\cdots\right.}{2b}\right.}{2b}\right.$$

$$\frac{d\left(\frac{\cos\left(\frac{\sqrt{-a}d}{\sqrt{b}}+c\right)\text{CosIntegral}\left(\frac{\sqrt{-a}d}{\sqrt{b}}-dx\right)}{2\sqrt{-a}\sqrt{b}}-\frac{\cos\left(c-\frac{\sqrt{-a}d}{\sqrt{b}}\right)\text{CosIntegral}\left(xd+\frac{\sqrt{-a}d}{\sqrt{b}}\right)}{2\sqrt{-a}\sqrt{b}}+\frac{\sin\left(\frac{\sqrt{-a}d}{\sqrt{b}}+c\right)\text{Si}\left(\frac{\sqrt{-a}d}{\sqrt{b}}-dx\right)}{2\sqrt{-a}\sqrt{b}}+\frac{\sin\left(c-\frac{\sqrt{-a}d}{\sqrt{b}}\right)\text{Si}\left(xd+\frac{\sqrt{-a}d}{\sqrt{b}}\right)}{2\sqrt{-a}\sqrt{b}}\right)}{2b}$$

$$2b$$

$$\frac{x^2\sin(c+dx)}{4b\left(a+bx^2\right)^2}$$

input
```
Int[(x^3*Sin[c + d*x])/(a + b*x^2)^3,x]
```

## 3.72. $\int \frac{x^3\sin(c+dx)}{\left(a+bx^2\right)^3}\,dx$

output
```
-1/4*(x^2*Sin[c + d*x])/(b*(a + b*x^2)^2) + (d*(-1/2*(x*Cos[c + d*x])/(b*(
a + b*x^2)) - (d*((CosIntegral[(Sqrt[-a]*d)/Sqrt[b] + d*x]*Sin[c - (Sqrt[-
a]*d)/Sqrt[b]])/(2*b) + (CosIntegral[(Sqrt[-a]*d)/Sqrt[b] - d*x]*Sin[c + (
Sqrt[-a]*d)/Sqrt[b]])/(2*b) - (Cos[c + (Sqrt[-a]*d)/Sqrt[b]]*SinIntegral[(
Sqrt[-a]*d)/Sqrt[b] - d*x])/(2*b) + (Cos[c - (Sqrt[-a]*d)/Sqrt[b]]*SinInte
gral[(Sqrt[-a]*d)/Sqrt[b] + d*x])/(2*b)))/(2*b) + ((Cos[c + (Sqrt[-a]*d)/S
qrt[b]]*CosIntegral[(Sqrt[-a]*d)/Sqrt[b] - d*x])/(2*Sqrt[-a]*Sqrt[b]) - (C
os[c - (Sqrt[-a]*d)/Sqrt[b]]*CosIntegral[(Sqrt[-a]*d)/Sqrt[b] + d*x])/(2*S
qrt[-a]*Sqrt[b]) + (Sin[c + (Sqrt[-a]*d)/Sqrt[b]]*SinIntegral[(Sqrt[-a]*d)
/Sqrt[b] - d*x])/(2*Sqrt[-a]*Sqrt[b]) + (Sin[c - (Sqrt[-a]*d)/Sqrt[b]]*Sin
Integral[(Sqrt[-a]*d)/Sqrt[b] + d*x])/(2*Sqrt[-a]*Sqrt[b]))/(2*b)))/(4*b)
+ (-1/2*Sin[c + d*x]/(b*(a + b*x^2)) + (d*((Cos[c + (Sqrt[-a]*d)/Sqrt[b]]*
CosIntegral[(Sqrt[-a]*d)/Sqrt[b] - d*x])/(2*Sqrt[-a]*Sqrt[b]) - (Cos[c - (
Sqrt[-a]*d)/Sqrt[b]]*CosIntegral[(Sqrt[-a]*d)/Sqrt[b] + d*x])/(2*Sqrt[-a]*
Sqrt[b]) + (Sin[c + (Sqrt[-a]*d)/Sqrt[b]]*SinIntegral[(Sqrt[-a]*d)/Sqrt[b]
 - d*x])/(2*Sqrt[-a]*Sqrt[b]) + (Sin[c - (Sqrt[-a]*d)/Sqrt[b]]*SinIntegral
[(Sqrt[-a]*d)/Sqrt[b] + d*x])/(2*Sqrt[-a]*Sqrt[b])))/(2*b))/(2*b)
```

#### 3.72.3.1 Defintions of rubi rules used

rule 2009
```
Int[u_, x_Symbol] :> Simp[IntSum[u, x], x] /; SumQ[u]
```

rule 3815
```
Int[Cos[(c_.) + (d_.)*(x_)]*((a_) + (b_.)*(x_)^(n_))^(p_), x_Symbol] :> Int
[ExpandIntegrand[Cos[c + d*x], (a + b*x^n)^p, x], x] /; FreeQ[{a, b, c, d},
 x] && ILtQ[p, 0] && IGtQ[n, 0] && (EqQ[n, 2] || EqQ[p, -1])
```

rule 3822
```
Int[((e_.)*(x_))^(m_.)*((a_) + (b_.)*(x_)^(n_))^(p_)*Sin[(c_.) + (d_.)*(x_)
], x_Symbol] :> Simp[e^m*(a + b*x^n)^(p + 1)*(Sin[c + d*x]/(b*n*(p + 1))),
x] - Simp[d*(e^m/(b*n*(p + 1)))   Int[(a + b*x^n)^(p + 1)*Cos[c + d*x], x],
 x] /; FreeQ[{a, b, c, d, e, m, n}, x] && ILtQ[p, -1] && EqQ[m, n - 1] && (
IntegerQ[n] || GtQ[e, 0])
```

rule 3824
```
Int[(x_)^(m_.)*((a_) + (b_.)*(x_)^(n_))^(p_)*Sin[(c_.) + (d_.)*(x_)], x_Sym
bol] :> Simp[x^(m - n + 1)*(a + b*x^n)^(p + 1)*(Sin[c + d*x]/(b*n*(p + 1)))
, x] + (-Simp[(m - n + 1)/(b*n*(p + 1))   Int[x^(m - n)*(a + b*x^n)^(p + 1)
*Sin[c + d*x], x], x] - Simp[d/(b*n*(p + 1))   Int[x^(m - n + 1)*(a + b*x^n
)^(p + 1)*Cos[c + d*x], x], x]) /; FreeQ[{a, b, c, d, m}, x] && ILtQ[p, -1]
 && IGtQ[n, 0] && (GtQ[m - n + 1, 0] || GtQ[n, 2]) && RationalQ[m]
```

rule 3825
```
Int[Cos[(c_.) + (d_.)*(x_)]*(x_)^(m_.)*((a_) + (b_.)*(x_)^(n_))^(p_), x_Sym
bol] :> Simp[x^(m - n + 1)*(a + b*x^n)^(p + 1)*(Cos[c + d*x]/(b*n*(p + 1)))
, x] + (-Simp[(m - n + 1)/(b*n*(p + 1))   Int[x^(m - n)*(a + b*x^n)^(p + 1)
*Cos[c + d*x], x], x] + Simp[d/(b*n*(p + 1))   Int[x^(m - n + 1)*(a + b*x^n
)^(p + 1)*Sin[c + d*x], x], x]) /; FreeQ[{a, b, c, d, m}, x] && ILtQ[p, -1]
 && IGtQ[n, 0] && (GtQ[m - n + 1, 0] || GtQ[n, 2]) && RationalQ[m]
```

rule 3826
```
Int[(x_)^(m_.)*((a_) + (b_.)*(x_)^(n_))^(p_)*Sin[(c_.) + (d_.)*(x_)], x_Sym
bol] :> Int[ExpandIntegrand[Sin[c + d*x], x^m*(a + b*x^n)^p, x], x] /; Free
Q[{a, b, c, d, m}, x] && ILtQ[p, 0] && IGtQ[n, 0] && (EqQ[n, 2] || EqQ[p, -
1]) && IntegerQ[m]
```

### 3.72.4 Maple [C] (verified)

Result contains complex when optimal does not.

Time = 1.10 (sec) , antiderivative size = 640, normalized size of antiderivative = 1.34

| method | result |
|---|---|
| risch | $-\frac{i d^2 e^{\frac{icb+d\sqrt{ab}}{b}} \mathrm{Ei}_1\left(\frac{icb+d\sqrt{ab}-b(idx+ic)}{b}\right)}{32b^3} - \frac{i d^2 e^{\frac{icb-d\sqrt{ab}}{b}} \mathrm{Ei}_1\left(-\frac{-icb+d\sqrt{ab}+b(idx+ic)}{b}\right)}{32b^3} - \frac{3id\sqrt{ab}\, e^{\frac{icb+d\sqrt{ab}}{b}} \mathrm{Ei}_1}{32a}$ |
| derivativedivides | Expression too large to display |
| default | Expression too large to display |

input
```
int(x^3*sin(d*x+c)/(b*x^2+a)^3,x,method=_RETURNVERBOSE)
```

output
```
-1/32*I*d^2/b^3*exp((I*c*b+d*(a*b)^(1/2))/b)*Ei(1,(I*c*b+d*(a*b)^(1/2)-b*(
I*d*x+I*c))/b)-1/32*I*d^2/b^3*exp((I*c*b-d*(a*b)^(1/2))/b)*Ei(1,-(-I*c*b+d
*(a*b)^(1/2)+b*(I*d*x+I*c))/b)-3/32*I*d/a/b^3*(a*b)^(1/2)*exp((I*c*b+d*(a*
b)^(1/2))/b)*Ei(1,(I*c*b+d*(a*b)^(1/2)-b*(I*d*x+I*c))/b)+3/32*I*d/a/b^3*(a
*b)^(1/2)*exp((I*c*b-d*(a*b)^(1/2))/b)*Ei(1,-(-I*c*b+d*(a*b)^(1/2)+b*(I*d*
x+I*c))/b)+1/32*I*d^2/b^3*Ei(1,-(I*c*b+d*(a*b)^(1/2)-b*(I*d*x+I*c))/b)*exp
(-(I*c*b+d*(a*b)^(1/2))/b)+1/32*I*d^2/b^3*exp(-(I*c*b-d*(a*b)^(1/2))/b)*Ei
(1,(-I*c*b+d*(a*b)^(1/2)+b*(I*d*x+I*c))/b)-3/32*I*d/a/b^3*Ei(1,-(I*c*b+d*(
a*b)^(1/2)-b*(I*d*x+I*c))/b)*(a*b)^(1/2)*exp(-(I*c*b+d*(a*b)^(1/2))/b)+3/3
2*I*d/a/b^3*exp(-(I*c*b-d*(a*b)^(1/2))/b)*Ei(1,(-I*c*b+d*(a*b)^(1/2)+b*(I*
d*x+I*c))/b)*(a*b)^(1/2)+1/8/a*(a*b*d^5*x^3+a^2*d^5*x)/b^2/(-b^2*d^4*x^4-2
*a*b*d^4*x^2-a^2*d^4)*cos(d*x+c)-1/8/d^2*(-4*a^2*b*d^6*x^2-2*a^3*d^6)/a^2/
b^2/(-b^2*d^4*x^4-2*a*b*d^4*x^2-a^2*d^4)*sin(d*x+c)
```

### 3.72.5 Fricas [C] (verification not implemented)

Result contains complex when optimal does not.

Time = 0.30 (sec) , antiderivative size = 492, normalized size of antiderivative = 1.03

$$\int \frac{x^3 \sin(c+dx)}{(a+bx^2)^3} \, dx =$$

$$-\frac{\left(-i\,ab^2d^2x^4 - 2i\,a^2bd^2x^2 - i\,a^3d^2 + 3\left(-i\,b^3x^4 - 2i\,ab^2x^2 - i\,a^2b\right)\sqrt{\frac{ad^2}{b}}\right)\operatorname{Ei}\left(i\,dx - \sqrt{\frac{ad^2}{b}}\right)e^{\left(i\,c+\sqrt{\frac{ad^2}{b}}\right)}}{}$$

input
```
integrate(x^3*sin(d*x+c)/(b*x^2+a)^3,x, algorithm="fricas")
```

output
```
-1/32*((-I*a*b^2*d^2*x^4 - 2*I*a^2*b*d^2*x^2 - I*a^3*d^2 + 3*(-I*b^3*x^4 -
 2*I*a*b^2*x^2 - I*a^2*b)*sqrt(a*d^2/b))*Ei(I*d*x - sqrt(a*d^2/b))*e^(I*c
+ sqrt(a*d^2/b)) + (-I*a*b^2*d^2*x^4 - 2*I*a^2*b*d^2*x^2 - I*a^3*d^2 + 3*(
I*b^3*x^4 + 2*I*a*b^2*x^2 + I*a^2*b)*sqrt(a*d^2/b))*Ei(I*d*x + sqrt(a*d^2/
b))*e^(I*c - sqrt(a*d^2/b)) + (I*a*b^2*d^2*x^4 + 2*I*a^2*b*d^2*x^2 + I*a^3
*d^2 + 3*(I*b^3*x^4 + 2*I*a*b^2*x^2 + I*a^2*b)*sqrt(a*d^2/b))*Ei(-I*d*x -
sqrt(a*d^2/b))*e^(-I*c + sqrt(a*d^2/b)) + (I*a*b^2*d^2*x^4 + 2*I*a^2*b*d^2
*x^2 + I*a^3*d^2 + 3*(-I*b^3*x^4 - 2*I*a*b^2*x^2 - I*a^2*b)*sqrt(a*d^2/b))
*Ei(-I*d*x + sqrt(a*d^2/b))*e^(-I*c - sqrt(a*d^2/b)) + 4*(a*b^2*d*x^3 + a^
2*b*d*x)*cos(d*x + c) + 8*(2*a*b^2*x^2 + a^2*b)*sin(d*x + c))/(a*b^5*x^4 +
 2*a^2*b^4*x^2 + a^3*b^3)
```

### 3.72.6 Sympy [F(-1)]

Timed out.

$$\int \frac{x^3 \sin(c+dx)}{(a+bx^2)^3} \, dx = \text{Timed out}$$

input
```
integrate(x**3*sin(d*x+c)/(b*x**2+a)**3,x)
```

output
```
Timed out
```

### 3.72.7 Maxima [F]

$$\int \frac{x^3 \sin(c+dx)}{(a+bx^2)^3}\,dx = \int \frac{x^3 \sin(dx+c)}{(bx^2+a)^3}\,dx$$

input
```
integrate(x^3*sin(d*x+c)/(b*x^2+a)^3,x, algorithm="maxima")
```

output
```
-1/2*(3*(cos(c)^2 + sin(c)^2)*d*x^2*sin(d*x + c) + ((d^2*x^3*cos(c) - 3*d*
x^2*sin(c) - 12*x*cos(c))*cos(d*x + c)^2 + (d^2*x^3*cos(c) - 3*d*x^2*sin(c
) - 12*x*cos(c))*sin(d*x + c)^2)*cos(d*x + 2*c) + ((cos(c)^2 + sin(c)^2)*d
^2*x^3 - 12*(cos(c)^2 + sin(c)^2)*x)*cos(d*x + c) - 2*(((b^3*cos(c)^2 + b^
3*sin(c)^2)*d^3*x^6 + 3*(a*b^2*cos(c)^2 + a*b^2*sin(c)^2)*d^3*x^4 + 3*(a^2
*b*cos(c)^2 + a^2*b*sin(c)^2)*d^3*x^2 + (a^3*cos(c)^2 + a^3*sin(c)^2)*d^3)
*cos(d*x + c)^2 + ((b^3*cos(c)^2 + b^3*sin(c)^2)*d^3*x^6 + 3*(a*b^2*cos(c)
^2 + a*b^2*sin(c)^2)*d^3*x^4 + 3*(a^2*b*cos(c)^2 + a^2*b*sin(c)^2)*d^3*x^2
 + (a^3*cos(c)^2 + a^3*sin(c)^2)*d^3)*sin(d*x + c)^2)*integrate(3*(3*a*d*x
*sin(d*x + c) + ((a*d^2 + 10*b)*x^2 - 2*a)*cos(d*x + c))/(b^4*d^3*x^8 + 4*
a*b^3*d^3*x^6 + 6*a^2*b^2*d^3*x^4 + 4*a^3*b*d^3*x^2 + a^4*d^3), x) - 2*(((
b^3*cos(c)^2 + b^3*sin(c)^2)*d^3*x^6 + 3*(a*b^2*cos(c)^2 + a*b^2*sin(c)^2)
*d^3*x^4 + 3*(a^2*b*cos(c)^2 + a^2*b*sin(c)^2)*d^3*x^2 + (a^3*cos(c)^2 + a
^3*sin(c)^2)*d^3)*cos(d*x + c)^2 + ((b^3*cos(c)^2 + b^3*sin(c)^2)*d^3*x^6
 + 3*(a*b^2*cos(c)^2 + a*b^2*sin(c)^2)*d^3*x^4 + 3*(a^2*b*cos(c)^2 + a^2*b*
sin(c)^2)*d^3*x^2 + (a^3*cos(c)^2 + a^3*sin(c)^2)*d^3)*sin(d*x + c)^2)*int
egrate(3*(3*a*d*x*sin(d*x + c) + ((a*d^2 + 10*b)*x^2 - 2*a)*cos(d*x + c))/
((b^4*d^3*x^8 + 4*a*b^3*d^3*x^6 + 6*a^2*b^2*d^3*x^4 + 4*a^3*b*d^3*x^2 + a^
4*d^3)*cos(d*x + c)^2 + (b^4*d^3*x^8 + 4*a*b^3*d^3*x^6 + 6*a^2*b^2*d^3*x^4
 + 4*a^3*b*d^3*x^2 + a^4*d^3)*sin(d*x + c)^2), x) + ((d^2*x^3*sin(c) + ...
```

### 3.72.8 Giac [F]

$$\int \frac{x^3 \sin(c+dx)}{(a+bx^2)^3}\,dx = \int \frac{x^3 \sin(dx+c)}{(bx^2+a)^3}\,dx$$

input
```
integrate(x^3*sin(d*x+c)/(b*x^2+a)^3,x, algorithm="giac")
```

output
```
integrate(x^3*sin(d*x + c)/(b*x^2 + a)^3, x)
```

### 3.72.9 Mupad [F(-1)]

Timed out.

$$\int \frac{x^3 \sin(c+dx)}{(a+bx^2)^3} \, dx = \int \frac{x^3 \sin(c+d\,x)}{(b\,x^2+a)^3} \, dx$$

input
```
int((x^3*sin(c + d*x))/(a + b*x^2)^3,x)
```

output
```
int((x^3*sin(c + d*x))/(a + b*x^2)^3, x)
```

# 3.73 $\int \frac{x^2 \sin(c+dx)}{\left(a+bx^2\right)^3} dx$

### 3.73.1 Optimal result

Integrand size = 19, antiderivative size = 746

$$\int \frac{x^2 \sin(c+dx)}{(a+bx^2)^3}\,dx = -\frac{d\cos(c+dx)}{8b^2(a+bx^2)} - \frac{d\cos\left(c+\frac{\sqrt{-a}d}{\sqrt{b}}\right)\text{CosIntegral}\left(\frac{\sqrt{-a}d}{\sqrt{b}}-dx\right)}{16ab^2}$$
$$-\frac{d\cos\left(c-\frac{\sqrt{-a}d}{\sqrt{b}}\right)\text{CosIntegral}\left(\frac{\sqrt{-a}d}{\sqrt{b}}+dx\right)}{16ab^2}$$
$$+\frac{\text{CosIntegral}\left(\frac{\sqrt{-a}d}{\sqrt{b}}+dx\right)\sin\left(c-\frac{\sqrt{-a}d}{\sqrt{b}}\right)}{16(-a)^{3/2}b^{3/2}}$$
$$+\frac{d^2\,\text{CosIntegral}\left(\frac{\sqrt{-a}d}{\sqrt{b}}+dx\right)\sin\left(c-\frac{\sqrt{-a}d}{\sqrt{b}}\right)}{16\sqrt{-a}b^{5/2}}$$
$$-\frac{\text{CosIntegral}\left(\frac{\sqrt{-a}d}{\sqrt{b}}-dx\right)\sin\left(c+\frac{\sqrt{-a}d}{\sqrt{b}}\right)}{16(-a)^{3/2}b^{3/2}}$$
$$-\frac{d^2\,\text{CosIntegral}\left(\frac{\sqrt{-a}d}{\sqrt{b}}-dx\right)\sin\left(c+\frac{\sqrt{-a}d}{\sqrt{b}}\right)}{16\sqrt{-a}b^{5/2}}$$
$$-\frac{\sin(c+dx)}{16ab^{3/2}\left(\sqrt{-a}-\sqrt{b}x\right)}+\frac{\sin(c+dx)}{16ab^{3/2}\left(\sqrt{-a}+\sqrt{b}x\right)}$$
$$-\frac{x\sin(c+dx)}{4b(a+bx^2)^2}+\frac{\cos\left(c+\frac{\sqrt{-a}d}{\sqrt{b}}\right)\text{Si}\left(\frac{\sqrt{-a}d}{\sqrt{b}}-dx\right)}{16(-a)^{3/2}b^{3/2}}$$
$$+\frac{d^2\cos\left(c+\frac{\sqrt{-a}d}{\sqrt{b}}\right)\text{Si}\left(\frac{\sqrt{-a}d}{\sqrt{b}}-dx\right)}{16\sqrt{-a}b^{5/2}}$$
$$-\frac{d\sin\left(c+\frac{\sqrt{-a}d}{\sqrt{b}}\right)\text{Si}\left(\frac{\sqrt{-a}d}{\sqrt{b}}-dx\right)}{16ab^2}+\frac{\cos\left(c-\frac{\sqrt{-a}d}{\sqrt{b}}\right)\text{Si}\left(\frac{\sqrt{-a}d}{\sqrt{b}}+dx\right)}{16(-a)^{3/2}b^{3/2}}$$
$$+\frac{d^2\cos\left(c-\frac{\sqrt{-a}d}{\sqrt{b}}\right)\text{Si}\left(\frac{\sqrt{-a}d}{\sqrt{b}}+dx\right)}{16\sqrt{-a}b^{5/2}}$$
$$+\frac{d\sin\left(c-\frac{\sqrt{-a}d}{\sqrt{b}}\right)\text{Si}\left(\frac{\sqrt{-a}d}{\sqrt{b}}+dx\right)}{16ab^2}$$

output
```
-1/8*d*cos(d*x+c)/b^2/(b*x^2+a)-1/16*d*Ci(d*x+d*(-a)^(1/2)/b^(1/2))*cos(c-
d*(-a)^(1/2)/b^(1/2))/a/b^2-1/16*d*Ci(-d*x+d*(-a)^(1/2)/b^(1/2))*cos(c+d*(
-a)^(1/2)/b^(1/2))/a/b^2-1/16*cos(c+d*(-a)^(1/2)/b^(1/2))*Si(d*x-d*(-a)^(1
/2)/b^(1/2))/(-a)^(3/2)/b^(3/2)+1/16*cos(c-d*(-a)^(1/2)/b^(1/2))*Si(d*x+d*
(-a)^(1/2)/b^(1/2))/(-a)^(3/2)/b^(3/2)-1/4*x*sin(d*x+c)/b/(b*x^2+a)^2+1/16
*Ci(d*x+d*(-a)^(1/2)/b^(1/2))*sin(c-d*(-a)^(1/2)/b^(1/2))/(-a)^(3/2)/b^(3/
2)+1/16*d*Si(d*x+d*(-a)^(1/2)/b^(1/2))*sin(c-d*(-a)^(1/2)/b^(1/2))/a/b^2-1
/16*Ci(-d*x+d*(-a)^(1/2)/b^(1/2))*sin(c+d*(-a)^(1/2)/b^(1/2))/(-a)^(3/2)/b
^(3/2)+1/16*d*Si(d*x-d*(-a)^(1/2)/b^(1/2))*sin(c+d*(-a)^(1/2)/b^(1/2))/a/b
^2-1/16*d^2*cos(c+d*(-a)^(1/2)/b^(1/2))*Si(d*x-d*(-a)^(1/2)/b^(1/2))/b^(5/
2)/(-a)^(1/2)+1/16*d^2*cos(c-d*(-a)^(1/2)/b^(1/2))*Si(d*x+d*(-a)^(1/2)/b^(
1/2))/b^(5/2)/(-a)^(1/2)+1/16*d^2*Ci(d*x+d*(-a)^(1/2)/b^(1/2))*sin(c-d*(-a
)^(1/2)/b^(1/2))/b^(5/2)/(-a)^(1/2)-1/16*d^2*Ci(-d*x+d*(-a)^(1/2)/b^(1/2))
*sin(c+d*(-a)^(1/2)/b^(1/2))/b^(5/2)/(-a)^(1/2)-1/16*sin(d*x+c)/a/b^(3/2)/
((-a)^(1/2)-x*b^(1/2))+1/16*sin(d*x+c)/a/b^(3/2)/((-a)^(1/2)+x*b^(1/2))
```

### 3.73.2 Mathematica [C] (verified)

Result contains complex when optimal does not.

Time = 3.36 (sec) , antiderivative size = 364, normalized size of antiderivative = 0.49

$$\int \frac{x^2\sin(c+dx)}{(a+bx^2)^3}\,dx$$
$$= \frac{e^{-ic-\frac{\sqrt{a}d}{\sqrt{b}}}\left(\left(b-\sqrt{a}\sqrt{b}d-ad^2\right)e^{\frac{2\sqrt{a}d}{\sqrt{b}}}\operatorname{ExpIntegralEi}\left(-\frac{\sqrt{a}d}{\sqrt{b}}-idx\right)-\left(b+\sqrt{a}\sqrt{b}d-ad^2\right)\operatorname{ExpIntegralEi}\right.}{}$$

input
```
Integrate[(x^2*Sin[c + d*x])/(a + b*x^2)^3,x]
```

output
```
(E^((-I)*c - (Sqrt[a]*d)/Sqrt[b])*((b - Sqrt[a]*Sqrt[b]*d - a*d^2)*E^((2*S
qrt[a]*d)/Sqrt[b])*ExpIntegralEi[-((Sqrt[a]*d)/Sqrt[b]) - I*d*x] - (b + Sq
rt[a]*Sqrt[b]*d - a*d^2)*ExpIntegralEi[(Sqrt[a]*d)/Sqrt[b] - I*d*x]) + E^(
I*c - (Sqrt[a]*d)/Sqrt[b])*((b - Sqrt[a]*Sqrt[b]*d - a*d^2)*E^((2*Sqrt[a]*
d)/Sqrt[b])*ExpIntegralEi[-((Sqrt[a]*d)/Sqrt[b]) + I*d*x] - (b + Sqrt[a]*S
qrt[b]*d - a*d^2)*ExpIntegralEi[(Sqrt[a]*d)/Sqrt[b] + I*d*x]) - (4*Sqrt[a]
*Sqrt[b]*Cos[d*x]*(a*d*(a + b*x^2)*Cos[c] + b*x*(a - b*x^2)*Sin[c]))/(a +
b*x^2)^2 + (4*Sqrt[a]*Sqrt[b]*(b*x*(-a + b*x^2)*Cos[c] + a*d*(a + b*x^2)*S
in[c])*Sin[d*x])/(a + b*x^2)^2)/(32*a^(3/2)*b^(5/2))
```

### 3.73.3 Rubi [A] (verified)

Time = 1.80 (sec) , antiderivative size = 759, normalized size of antiderivative = 1.02, number of steps used = 6, number of rules used = 6, $\frac{\text{number of rules}}{\text{integrand size}}$ = 0.316, Rules used = {3824, 3814, 2009, 3823, 3814, 2009}

Below are the steps used by Rubi to obtain the solution. The rule number used for the transformation is given above next to the arrow. The rules definitions used are listed below.

$$\int \frac{x^2 \sin(c+dx)}{(a+bx^2)^3}dx$$

$$\Big\downarrow \text{3824}$$

$$\frac{\int \frac{\sin(c+dx)}{(bx^2+a)^2}dx}{4b}+\frac{d\int \frac{x\cos(c+dx)}{(bx^2+a)^2}dx}{4b}-\frac{x\sin(c+dx)}{4b(a+bx^2)^2}$$

$$\Big\downarrow \text{3814}$$

$$\frac{\int \left(-\frac{b\sin(c+dx)}{2a(-b^2x^2-ab)}-\frac{b\sin(c+dx)}{4a\left(\sqrt{-a}\sqrt{b}-bx\right)^2}-\frac{b\sin(c+dx)}{4a\left(bx+\sqrt{-a}\sqrt{b}\right)^2}\right)dx}{4b}+\frac{d\int \frac{x\cos(c+dx)}{(bx^2+a)^2}dx}{4b}-\frac{x\sin(c+dx)}{4b(a+bx^2)^2}$$

$$\Big\downarrow \text{2009}$$

$$\frac{d\int \frac{x\cos(c+dx)}{(bx^2+a)^2}dx}{4b}+$$

$$\frac{-\frac{\sin\left(\frac{\sqrt{-a}d}{\sqrt{b}}+c\right)\text{CosIntegral}\left(\frac{\sqrt{-a}d}{\sqrt{b}}-dx\right)}{4(-a)^{3/2}\sqrt{b}}+\frac{\sin\left(c-\frac{\sqrt{-a}d}{\sqrt{b}}\right)\text{CosIntegral}\left(xd+\frac{\sqrt{-a}d}{\sqrt{b}}\right)}{4(-a)^{3/2}\sqrt{b}}-\frac{d\cos\left(\frac{\sqrt{-a}d}{\sqrt{b}}+c\right)\text{CosIntegral}\left(\frac{\sqrt{-a}d}{\sqrt{b}}-dx\right)}{4ab}-\frac{d\cos\left(c-\right.}{}}{}$$

$$\frac{x\sin(c+dx)}{4b(a+bx^2)^2}$$

$$\Big\downarrow \text{3823}$$

$$\frac{d\left(-\frac{d\int \frac{\sin(c+dx)}{bx^2+a}dx}{2b}-\frac{\cos(c+dx)}{2b(a+bx^2)}\right)}{4b}+$$

$$\frac{-\frac{\sin\left(\frac{\sqrt{-a}d}{\sqrt{b}}+c\right)\text{CosIntegral}\left(\frac{\sqrt{-a}d}{\sqrt{b}}-dx\right)}{4(-a)^{3/2}\sqrt{b}}+\frac{\sin\left(c-\frac{\sqrt{-a}d}{\sqrt{b}}\right)\text{CosIntegral}\left(xd+\frac{\sqrt{-a}d}{\sqrt{b}}\right)}{4(-a)^{3/2}\sqrt{b}}-\frac{d\cos\left(\frac{\sqrt{-a}d}{\sqrt{b}}+c\right)\text{CosIntegral}\left(\frac{\sqrt{-a}d}{\sqrt{b}}-dx\right)}{4ab}-\frac{d\cos\left(c-\right.}{}}{}$$

$$\frac{x\sin(c+dx)}{4b(a+bx^2)^2}$$

$$\Big\downarrow \text{3814}$$

$$\frac{d\left(-\frac{d\int\left(\frac{\sqrt{-a}\sin(c+dx)}{2a\left(\sqrt{-a}-\sqrt{b}x\right)}+\frac{\sqrt{-a}\sin(c+dx)}{2a\left(\sqrt{b}x+\sqrt{-a}\right)}\right)dx}{2b}-\frac{\cos(c+dx)}{2b(a+bx^2)}\right)}{4b}+$$

$$-\frac{\sin\left(\frac{\sqrt{-a}d}{\sqrt{b}}+c\right)\text{CosIntegral}\left(\frac{\sqrt{-a}d}{\sqrt{b}}-dx\right)}{4(-a)^{3/2}\sqrt{b}}+\frac{\sin\left(c-\frac{\sqrt{-a}d}{\sqrt{b}}\right)\text{CosIntegral}\left(xd+\frac{\sqrt{-a}d}{\sqrt{b}}\right)}{4(-a)^{3/2}\sqrt{b}}-\frac{d\cos\left(\frac{\sqrt{-a}d}{\sqrt{b}}+c\right)\text{CosIntegral}\left(\frac{\sqrt{-a}d}{\sqrt{b}}-dx\right)}{4ab}-\frac{d\cos\left(c-\right.}{}$$

$$\frac{x\sin(c+dx)}{4b\left(a+bx^2\right)^2}$$

$$\Big\downarrow \text{2009}$$

$$\frac{d\left(-\frac{d\left(-\frac{\sin\left(c-\frac{\sqrt{-a}d}{\sqrt{b}}\right)\text{CosIntegral}\left(xd+\frac{\sqrt{-a}d}{\sqrt{b}}\right)}{2\sqrt{-a}\sqrt{b}}+\frac{\sin\left(\frac{\sqrt{-a}d}{\sqrt{b}}+c\right)\text{CosIntegral}\left(\frac{\sqrt{-a}d}{\sqrt{b}}-dx\right)}{2\sqrt{-a}\sqrt{b}}-\frac{\cos\left(\frac{\sqrt{-a}d}{\sqrt{b}}+c\right)\text{Si}\left(\frac{\sqrt{-a}d}{\sqrt{b}}-dx\right)}{2\sqrt{-a}\sqrt{b}}-\frac{\cos\left(c-\frac{\sqrt{-a}d}{\sqrt{b}}\right)\text{Si}\left(xd+\right.}{2\sqrt{-a}\sqrt{b}}}{2b}\right.}{4b}$$

$$-\frac{\sin\left(\frac{\sqrt{-a}d}{\sqrt{b}}+c\right)\text{CosIntegral}\left(\frac{\sqrt{-a}d}{\sqrt{b}}-dx\right)}{4(-a)^{3/2}\sqrt{b}}+\frac{\sin\left(c-\frac{\sqrt{-a}d}{\sqrt{b}}\right)\text{CosIntegral}\left(xd+\frac{\sqrt{-a}d}{\sqrt{b}}\right)}{4(-a)^{3/2}\sqrt{b}}-\frac{d\cos\left(\frac{\sqrt{-a}d}{\sqrt{b}}+c\right)\text{CosIntegral}\left(\frac{\sqrt{-a}d}{\sqrt{b}}-dx\right)}{4ab}-\frac{d\cos\left(c-\right.}{}$$

$$\frac{x\sin(c+dx)}{4b\left(a+bx^2\right)^2}$$

input
```
Int[(x^2*Sin[c + d*x])/(a + b*x^2)^3,x]
```

## 3.73. $\int \frac{x^2\sin(c+dx)}{(a+bx^2)^3}\,dx$

output
```
-1/4*(x*Sin[c + d*x])/(b*(a + b*x^2)^2) + (-1/4*(d*Cos[c + (Sqrt[-a]*d)/Sq
rt[b]]*CosIntegral[(Sqrt[-a]*d)/Sqrt[b] - d*x])/(a*b) - (d*Cos[c - (Sqrt[-
a]*d)/Sqrt[b]]*CosIntegral[(Sqrt[-a]*d)/Sqrt[b] + d*x])/(4*a*b) + (CosInte
gral[(Sqrt[-a]*d)/Sqrt[b] + d*x]*Sin[c - (Sqrt[-a]*d)/Sqrt[b]])/(4*(-a)^(3
/2)*Sqrt[b]) - (CosIntegral[(Sqrt[-a]*d)/Sqrt[b] - d*x]*Sin[c + (Sqrt[-a]*
d)/Sqrt[b]])/(4*(-a)^(3/2)*Sqrt[b]) - Sin[c + d*x]/(4*a*Sqrt[b]*(Sqrt[-a]
- Sqrt[b]*x)) + Sin[c + d*x]/(4*a*Sqrt[b]*(Sqrt[-a] + Sqrt[b]*x)) + (Cos[c
 + (Sqrt[-a]*d)/Sqrt[b]]*SinIntegral[(Sqrt[-a]*d)/Sqrt[b] - d*x])/(4*(-a)^
(3/2)*Sqrt[b]) - (d*Sin[c + (Sqrt[-a]*d)/Sqrt[b]]*SinIntegral[(Sqrt[-a]*d)
/Sqrt[b] - d*x])/(4*a*b) + (Cos[c - (Sqrt[-a]*d)/Sqrt[b]]*SinIntegral[(Sqr
t[-a]*d)/Sqrt[b] + d*x])/(4*(-a)^(3/2)*Sqrt[b]) + (d*Sin[c - (Sqrt[-a]*d)/
Sqrt[b]]*SinIntegral[(Sqrt[-a]*d)/Sqrt[b] + d*x])/(4*a*b))/(4*b) + (d*(-1/
2*Cos[c + d*x]/(b*(a + b*x^2)) - (d*(-1/2*(CosIntegral[(Sqrt[-a]*d)/Sqrt[b
] + d*x]*Sin[c - (Sqrt[-a]*d)/Sqrt[b]])/(Sqrt[-a]*Sqrt[b]) + (CosIntegral[
(Sqrt[-a]*d)/Sqrt[b] - d*x]*Sin[c + (Sqrt[-a]*d)/Sqrt[b]])/(2*Sqrt[-a]*Sqr
t[b]) - (Cos[c + (Sqrt[-a]*d)/Sqrt[b]]*SinIntegral[(Sqrt[-a]*d)/Sqrt[b] -
d*x])/(2*Sqrt[-a]*Sqrt[b]) - (Cos[c - (Sqrt[-a]*d)/Sqrt[b]]*SinIntegral[(S
qrt[-a]*d)/Sqrt[b] + d*x])/(2*Sqrt[-a]*Sqrt[b])))/(2*b)))/(4*b)
```

#### 3.73.3.1 Defintions of rubi rules used

rule 2009
```
Int[u_, x_Symbol] :> Simp[IntSum[u, x], x] /; SumQ[u]
```

rule 3814
```
Int[((a_) + (b_.)*(x_)^(n_))^(p_)*Sin[(c_.) + (d_.)*(x_)], x_Symbol] :> Int
[ExpandIntegrand[Sin[c + d*x], (a + b*x^n)^p, x], x] /; FreeQ[{a, b, c, d},
 x] && ILtQ[p, 0] && IGtQ[n, 0] && (EqQ[n, 2] || EqQ[p, -1])
```

rule 3823
```
Int[Cos[(c_.) + (d_.)*(x_)]*((e_.)*(x_))^(m_.)*((a_) + (b_.)*(x_)^(n_))^(p_
), x_Symbol] :> Simp[e^m*(a + b*x^n)^(p + 1)*(Cos[c + d*x]/(b*n*(p + 1))),
x] + Simp[d*(e^m/(b*n*(p + 1)))   Int[(a + b*x^n)^(p + 1)*Sin[c + d*x], x],
 x] /; FreeQ[{a, b, c, d, e, m, n}, x] && ILtQ[p, -1] && EqQ[m, n - 1] && (
IntegerQ[n] || GtQ[e, 0])
```

rule 3824
```
Int[(x_)^(m_.)*((a_) + (b_.)*(x_)^(n_))^(p_)*Sin[(c_.) + (d_.)*(x_)], x_Sym
bol] :> Simp[x^(m - n + 1)*(a + b*x^n)^(p + 1)*(Sin[c + d*x]/(b*n*(p + 1)))
, x] + (-Simp[(m - n + 1)/(b*n*(p + 1))   Int[x^(m - n)*(a + b*x^n)^(p + 1)
*Sin[c + d*x], x], x] - Simp[d/(b*n*(p + 1))   Int[x^(m - n + 1)*(a + b*x^n
)^(p + 1)*Cos[c + d*x], x], x]) /; FreeQ[{a, b, c, d, m}, x] && ILtQ[p, -1]
 && IGtQ[n, 0] && (GtQ[m - n + 1, 0] || GtQ[n, 2]) && RationalQ[m]
```

### 3.73.4 Maple [C] (verified)

Result contains complex when optimal does not.

Time = 0.86 (sec) , antiderivative size = 912, normalized size of antiderivative = 1.22

| method | result |
|---|---|
| risch | $\frac{d^2 \operatorname{Ei}_1\left(\frac{icb+d\sqrt{ab}-b(idx+ic)}{b}\right)e^{\frac{icb+d\sqrt{ab}}{b}}\sqrt{ab}}{32b^3a} - \frac{d^2 \operatorname{Ei}_1\left(\frac{icb-d\sqrt{ab}-b(idx+ic)}{b}\right)e^{\frac{icb-d\sqrt{ab}}{b}}\sqrt{ab}}{32b^3a} + \frac{d \operatorname{Ei}_1\left(\frac{icb+d\sqrt{ab}-b(idx}{b}\right.}{32b^2a}$ |
| derivativedivides | Expression too large to display |
| default | Expression too large to display |

input
```
int(x^2*sin(d*x+c)/(b*x^2+a)^3,x,method=_RETURNVERBOSE)
```

output
```
1/32*d^2/b^3/a*Ei(1,(I*c*b+d*(a*b)^(1/2)-b*(I*d*x+I*c))/b)*exp((I*c*b+d*(a
*b)^(1/2))/b)*(a*b)^(1/2)-1/32*d^2/b^3/a*Ei(1,(I*c*b-d*(a*b)^(1/2)-b*(I*d*
x+I*c))/b)*exp((I*c*b-d*(a*b)^(1/2))/b)*(a*b)^(1/2)+1/32*d/b^2/a*Ei(1,(I*c
*b+d*(a*b)^(1/2)-b*(I*d*x+I*c))/b)*exp((I*c*b+d*(a*b)^(1/2))/b)+1/32*d/b^2
/a*Ei(1,(I*c*b-d*(a*b)^(1/2)-b*(I*d*x+I*c))/b)*exp((I*c*b-d*(a*b)^(1/2))/b
)-1/32/b^2/a^2*Ei(1,(I*c*b+d*(a*b)^(1/2)-b*(I*d*x+I*c))/b)*exp((I*c*b+d*(a
*b)^(1/2))/b)*(a*b)^(1/2)+1/32/b^2/a^2*Ei(1,(I*c*b-d*(a*b)^(1/2)-b*(I*d*x+
I*c))/b)*exp((I*c*b-d*(a*b)^(1/2))/b)*(a*b)^(1/2)-1/32*d^2/b^3/a*exp(-(I*c
*b+d*(a*b)^(1/2))/b)*Ei(1,-(I*c*b+d*(a*b)^(1/2)-b*(I*d*x+I*c))/b)*(a*b)^(1
/2)+1/32*d^2/b^3/a*exp(-(I*c*b-d*(a*b)^(1/2))/b)*Ei(1,-(I*c*b-d*(a*b)^(1/2
)-b*(I*d*x+I*c))/b)*(a*b)^(1/2)+1/32*d/b^2/a*exp(-(I*c*b+d*(a*b)^(1/2))/b)
*Ei(1,-(I*c*b+d*(a*b)^(1/2)-b*(I*d*x+I*c))/b)+1/32*d/b^2/a*exp(-(I*c*b-d*(
a*b)^(1/2))/b)*Ei(1,-(I*c*b-d*(a*b)^(1/2)-b*(I*d*x+I*c))/b)+1/32/b^2/a^2*e
xp(-(I*c*b+d*(a*b)^(1/2))/b)*Ei(1,-(I*c*b+d*(a*b)^(1/2)-b*(I*d*x+I*c))/b)*
(a*b)^(1/2)-1/32/b^2/a^2*exp(-(I*c*b-d*(a*b)^(1/2))/b)*Ei(1,-(I*c*b-d*(a*b
)^(1/2)-b*(I*d*x+I*c))/b)*(a*b)^(1/2)-1/8*d/a*(-a*b*d^4*x^2-a^2*d^4)/b^2/(
-b^2*d^4*x^4-2*a*b*d^4*x^2-a^2*d^4)*cos(d*x+c)+1/8/d/b*(-a*b*d^5*x^3+a^2*d
^5*x)/a^2/(-b^2*d^4*x^4-2*a*b*d^4*x^2-a^2*d^4)*sin(d*x+c)
```

### 3.73.5 Fricas [C] (verification not implemented)

Result contains complex when optimal does not.

Time = 0.32 (sec) , antiderivative size = 604, normalized size of antiderivative = 0.81

$$\int \frac{x^2\sin(c+dx)}{(a+bx^2)^3}\,dx =$$

$$-\frac{\left(ab^2d^2x^4+2\,a^2bd^2x^2+a^3d^2+(a^3d^2+(ab^2d^2-b^3)x^4-a^2b+2\,(a^2bd^2-ab^2)x^2)\sqrt{\frac{ad^2}{b}}\right)\mathrm{Ei}\left(i\,dx-\sqrt{\cdots}\right.}{\cdots}$$

input
```
integrate(x^2*sin(d*x+c)/(b*x^2+a)^3,x, algorithm="fricas")
```

output
```
-1/32*((a*b^2*d^2*x^4 + 2*a^2*b*d^2*x^2 + a^3*d^2 + (a^3*d^2 + (a*b^2*d^2
- b^3)*x^4 - a^2*b + 2*(a^2*b*d^2 - a*b^2)*x^2)*sqrt(a*d^2/b))*Ei(I*d*x -
sqrt(a*d^2/b))*e^(I*c + sqrt(a*d^2/b)) + (a*b^2*d^2*x^4 + 2*a^2*b*d^2*x^2
+ a^3*d^2 - (a^3*d^2 + (a*b^2*d^2 - b^3)*x^4 - a^2*b + 2*(a^2*b*d^2 - a*b^
2)*x^2)*sqrt(a*d^2/b))*Ei(I*d*x + sqrt(a*d^2/b))*e^(I*c - sqrt(a*d^2/b)) +
 (a*b^2*d^2*x^4 + 2*a^2*b*d^2*x^2 + a^3*d^2 + (a^3*d^2 + (a*b^2*d^2 - b^3)
*x^4 - a^2*b + 2*(a^2*b*d^2 - a*b^2)*x^2)*sqrt(a*d^2/b))*Ei(-I*d*x - sqrt(
a*d^2/b))*e^(-I*c + sqrt(a*d^2/b)) + (a*b^2*d^2*x^4 + 2*a^2*b*d^2*x^2 + a^
3*d^2 - (a^3*d^2 + (a*b^2*d^2 - b^3)*x^4 - a^2*b + 2*(a^2*b*d^2 - a*b^2)*x
^2)*sqrt(a*d^2/b))*Ei(-I*d*x + sqrt(a*d^2/b))*e^(-I*c - sqrt(a*d^2/b)) + 4
*(a^2*b*d^2*x^2 + a^3*d^2)*cos(d*x + c) - 4*(a*b^2*d*x^3 - a^2*b*d*x)*sin(
d*x + c))/(a^2*b^4*d*x^4 + 2*a^3*b^3*d*x^2 + a^4*b^2*d)
```

### 3.73.6 Sympy [F(-1)]

Timed out.

$$\int \frac{x^2\sin(c+dx)}{(a+bx^2)^3}\,dx = \text{Timed out}$$

input
```
integrate(x**2*sin(d*x+c)/(b*x**2+a)**3,x)
```

output
```
Timed out
```

### 3.73.7 Maxima [F]

$$\int \frac{x^2 \sin(c+dx)}{(a+bx^2)^3} \, dx = \int \frac{x^2 \sin(dx+c)}{(bx^2+a)^3} \, dx$$

input
```
integrate(x^2*sin(d*x+c)/(b*x^2+a)^3,x, algorithm="maxima")
```

output
```
-1/2*((cos(c)^2 + sin(c)^2)*d*x^2*cos(d*x + c) + 4*(cos(c)^2 + sin(c)^2)*x
*sin(d*x + c) + ((d*x^2*cos(c) - 4*x*sin(c))*cos(d*x + c)^2 + (d*x^2*cos(c
) - 4*x*sin(c))*sin(d*x + c)^2)*cos(d*x + 2*c) + 2*(((b^3*cos(c)^2 + b^3*s
in(c)^2)*d^2*x^6 + 3*(a*b^2*cos(c)^2 + a*b^2*sin(c)^2)*d^2*x^4 + 3*(a^2*b*
cos(c)^2 + a^2*b*sin(c)^2)*d^2*x^2 + (a^3*cos(c)^2 + a^3*sin(c)^2)*d^2)*co
s(d*x + c)^2 + ((b^3*cos(c)^2 + b^3*sin(c)^2)*d^2*x^6 + 3*(a*b^2*cos(c)^2
+ a*b^2*sin(c)^2)*d^2*x^4 + 3*(a^2*b*cos(c)^2 + a^2*b*sin(c)^2)*d^2*x^2 +
(a^3*cos(c)^2 + a^3*sin(c)^2)*d^2)*sin(d*x + c)^2)*integrate(-(3*a*d*x*cos
(d*x + c) - 2*(5*b*x^2 - a)*sin(d*x + c))/(b^4*d^2*x^8 + 4*a*b^3*d^2*x^6 +
 6*a^2*b^2*d^2*x^4 + 4*a^3*b*d^2*x^2 + a^4*d^2), x) + 2*(((b^3*cos(c)^2 +
b^3*sin(c)^2)*d^2*x^6 + 3*(a*b^2*cos(c)^2 + a*b^2*sin(c)^2)*d^2*x^4 + 3*(a
^2*b*cos(c)^2 + a^2*b*sin(c)^2)*d^2*x^2 + (a^3*cos(c)^2 + a^3*sin(c)^2)*d^
2)*cos(d*x + c)^2 + ((b^3*cos(c)^2 + b^3*sin(c)^2)*d^2*x^6 + 3*(a*b^2*cos(
c)^2 + a*b^2*sin(c)^2)*d^2*x^4 + 3*(a^2*b*cos(c)^2 + a^2*b*sin(c)^2)*d^2*x
^2 + (a^3*cos(c)^2 + a^3*sin(c)^2)*d^2)*sin(d*x + c)^2)*integrate(-(3*a*d*
x*cos(d*x + c) - 2*(5*b*x^2 - a)*sin(d*x + c))/((b^4*d^2*x^8 + 4*a*b^3*d^2
*x^6 + 6*a^2*b^2*d^2*x^4 + 4*a^3*b*d^2*x^2 + a^4*d^2)*cos(d*x + c)^2 + (b^
4*d^2*x^8 + 4*a*b^3*d^2*x^6 + 6*a^2*b^2*d^2*x^4 + 4*a^3*b*d^2*x^2 + a^4*d^
2)*sin(d*x + c)^2), x) + ((d*x^2*sin(c) + 4*x*cos(c))*cos(d*x + c)^2 + (d*
x^2*sin(c) + 4*x*cos(c))*sin(d*x + c)^2)*sin(d*x + 2*c))/(((b^3*cos(c)^...
```

### 3.73.8 Giac [F]

$$\int \frac{x^2 \sin(c+dx)}{(a+bx^2)^3} \, dx = \int \frac{x^2 \sin(dx+c)}{(bx^2+a)^3} \, dx$$

input
```
integrate(x^2*sin(d*x+c)/(b*x^2+a)^3,x, algorithm="giac")
```

output
```
integrate(x^2*sin(d*x + c)/(b*x^2 + a)^3, x)
```

### 3.73.9 Mupad [F(-1)]

Timed out.

$$\int \frac{x^2 \sin(c+dx)}{(a+bx^2)^3}\,dx = \int \frac{x^2\,\sin\left(c+d\,x\right)}{{\left(b\,x^2+a\right)}^3}\,dx$$

input
```
int((x^2*sin(c + d*x))/(a + b*x^2)^3,x)
```

output
```
int((x^2*sin(c + d*x))/(a + b*x^2)^3, x)
```

# 3.74 $\int \frac{x\sin(c+dx)}{(a+bx^2)^3}\,dx$



## 3.74.1 Optimal result

Integrand size = 17, antiderivative size = 512

$$\begin{aligned}\int \frac{x\sin(c+dx)}{(a+bx^2)^3}\,dx = &-\frac{d\cos(c+dx)}{16ab^{3/2}\left(\sqrt{-a}-\sqrt{b}x\right)}+\frac{d\cos(c+dx)}{16ab^{3/2}\left(\sqrt{-a}+\sqrt{b}x\right)}\\
&-\frac{d\cos\left(c+\frac{\sqrt{-a}d}{\sqrt{b}}\right)\operatorname{CosIntegral}\left(\frac{\sqrt{-a}d}{\sqrt{b}}-dx\right)}{16(-a)^{3/2}b^{3/2}}\\
&+\frac{d\cos\left(c-\frac{\sqrt{-a}d}{\sqrt{b}}\right)\operatorname{CosIntegral}\left(\frac{\sqrt{-a}d}{\sqrt{b}}+dx\right)}{16(-a)^{3/2}b^{3/2}}\\
&+\frac{d^2\operatorname{CosIntegral}\left(\frac{\sqrt{-a}d}{\sqrt{b}}+dx\right)\sin\left(c-\frac{\sqrt{-a}d}{\sqrt{b}}\right)}{16ab^2}\\
&+\frac{d^2\operatorname{CosIntegral}\left(\frac{\sqrt{-a}d}{\sqrt{b}}-dx\right)\sin\left(c+\frac{\sqrt{-a}d}{\sqrt{b}}\right)}{16ab^2}\\
&-\frac{\sin(c+dx)}{4b\,(a+bx^2)^2}-\frac{d^2\cos\left(c+\frac{\sqrt{-a}d}{\sqrt{b}}\right)\operatorname{Si}\left(\frac{\sqrt{-a}d}{\sqrt{b}}-dx\right)}{16ab^2}\\
&-\frac{d\sin\left(c+\frac{\sqrt{-a}d}{\sqrt{b}}\right)\operatorname{Si}\left(\frac{\sqrt{-a}d}{\sqrt{b}}-dx\right)}{16(-a)^{3/2}b^{3/2}}\\
&+\frac{d^2\cos\left(c-\frac{\sqrt{-a}d}{\sqrt{b}}\right)\operatorname{Si}\left(\frac{\sqrt{-a}d}{\sqrt{b}}+dx\right)}{16ab^2}\\
&-\frac{d\sin\left(c-\frac{\sqrt{-a}d}{\sqrt{b}}\right)\operatorname{Si}\left(\frac{\sqrt{-a}d}{\sqrt{b}}+dx\right)}{16(-a)^{3/2}b^{3/2}}\end{aligned}$$

output
```
1/16*d*Ci(d*x+d*(-a)^(1/2)/b^(1/2))*cos(c-d*(-a)^(1/2)/b^(1/2))/(-a)^(3/2)
/b^(3/2)-1/16*d*Ci(-d*x+d*(-a)^(1/2)/b^(1/2))*cos(c+d*(-a)^(1/2)/b^(1/2))/
(-a)^(3/2)/b^(3/2)+1/16*d^2*cos(c+d*(-a)^(1/2)/b^(1/2))*Si(d*x-d*(-a)^(1/2
)/b^(1/2))/a/b^2+1/16*d^2*cos(c-d*(-a)^(1/2)/b^(1/2))*Si(d*x+d*(-a)^(1/2)/
b^(1/2))/a/b^2-1/4*sin(d*x+c)/b/(b*x^2+a)^2+1/16*d^2*Ci(d*x+d*(-a)^(1/2)/b
^(1/2))*sin(c-d*(-a)^(1/2)/b^(1/2))/a/b^2-1/16*d*Si(d*x+d*(-a)^(1/2)/b^(1/
2))*sin(c-d*(-a)^(1/2)/b^(1/2))/(-a)^(3/2)/b^(3/2)+1/16*d^2*Ci(-d*x+d*(-a)
^(1/2)/b^(1/2))*sin(c+d*(-a)^(1/2)/b^(1/2))/a/b^2+1/16*d*Si(d*x-d*(-a)^(1/
2)/b^(1/2))*sin(c+d*(-a)^(1/2)/b^(1/2))/(-a)^(3/2)/b^(3/2)-1/16*d*cos(d*x+
c)/a/b^(3/2)/((-a)^(1/2)-x*b^(1/2))+1/16*d*cos(d*x+c)/a/b^(3/2)/((-a)^(1/2
)+x*b^(1/2))
```

### 3.74.2 Mathematica [C] (verified)

Result contains complex when optimal does not.

Time = 2.53 (sec) , antiderivative size = 317, normalized size of antiderivative = 0.62

$$\int \frac{x\sin(c+dx)}{(a+bx^2)^3}\,dx = \frac{ide^{-ic-\frac{\sqrt{a}d}{\sqrt{b}}}\left(-\left(\left(\sqrt{b}-\sqrt{a}d\right)e^{\frac{2\sqrt{a}d}{\sqrt{b}}}\text{ExpIntegralEi}\left(-\frac{\sqrt{a}d}{\sqrt{b}}-idx\right)\right)+\left(\sqrt{b}+\sqrt{a}d\right)\text{ExpIntegralEi}\left(\frac{\sqrt{a}d}{\sqrt{b}}-\right.\right.}{}$$

input
```
Integrate[(x*Sin[c + d*x])/(a + b*x^2)^3,x]
```

output
```
(I*d*E^((-I)*c - (Sqrt[a]*d)/Sqrt[b])*(-((Sqrt[b] - Sqrt[a]*d)*E^((2*Sqrt[
a]*d)/Sqrt[b])*ExpIntegralEi[-((Sqrt[a]*d)/Sqrt[b]) - I*d*x]) + (Sqrt[b] +
 Sqrt[a]*d)*ExpIntegralEi[(Sqrt[a]*d)/Sqrt[b] - I*d*x]) - I*d*E^(I*c - (Sq
rt[a]*d)/Sqrt[b])*(-((Sqrt[b] - Sqrt[a]*d)*E^((2*Sqrt[a]*d)/Sqrt[b])*ExpIn
tegralEi[-((Sqrt[a]*d)/Sqrt[b]) + I*d*x]) + (Sqrt[b] + Sqrt[a]*d)*ExpInteg
ralEi[(Sqrt[a]*d)/Sqrt[b] + I*d*x]) + (4*Sqrt[a]*b*Cos[d*x]*(d*x*(a + b*x^
2)*Cos[c] - 2*a*Sin[c]))/(a + b*x^2)^2 - (4*Sqrt[a]*b*(2*a*Cos[c] + d*x*(a
 + b*x^2)*Sin[c])*Sin[d*x])/(a + b*x^2)^2)/(32*a^(3/2)*b^2)
```

### 3.74.3 Rubi [A] (verified)

Time = 1.00 (sec) , antiderivative size = 507, normalized size of antiderivative = 0.99, number of steps used = 3, number of rules used = 3, $\frac{\text{number of rules}}{\text{integrand size}}$ = 0.176, Rules used = {3822, 3815, 2009}

Below are the steps used by Rubi to obtain the solution. The rule number used for the transformation is given above next to the arrow. The rules definitions used are listed below.

$$\int \frac{x\sin(c+dx)}{\left(a+bx^2\right)^3}dx$$

$$\Big\downarrow \text{3822}$$

$$\frac{d\int \frac{\cos(c+dx)}{\left(bx^2+a\right)^2}dx}{4b}-\frac{\sin(c+dx)}{4b\left(a+bx^2\right)^2}$$

$$\Big\downarrow \text{3815}$$

$$\frac{d\int \left(-\frac{b\cos(c+dx)}{2a\left(-b^2x^2-ab\right)}-\frac{b\cos(c+dx)}{4a\left(\sqrt{-a}\sqrt{b}-bx\right)^2}-\frac{b\cos(c+dx)}{4a\left(bx+\sqrt{-a}\sqrt{b}\right)^2}\right)dx}{4b}-\frac{\sin(c+dx)}{4b\left(a+bx^2\right)^2}$$

$$\Big\downarrow \text{2009}$$

$$d\left(\frac{d\sin\left(c-\frac{\sqrt{-a}d}{\sqrt{b}}\right)\text{CosIntegral}\left(xd+\frac{\sqrt{-a}d}{\sqrt{b}}\right)}{4ab}+\frac{d\sin\left(\frac{\sqrt{-a}d}{\sqrt{b}}+c\right)\text{CosIntegral}\left(\frac{\sqrt{-a}d}{\sqrt{b}}-dx\right)}{4ab}-\frac{\cos\left(\frac{\sqrt{-a}d}{\sqrt{b}}+c\right)\text{CosIntegral}\left(\frac{\sqrt{-a}d}{\sqrt{b}}-dx\right)}{4(-a)^{3/2}\sqrt{b}}+\frac{\cos(\ldots}{}\right.$$

$$\frac{\sin(c+dx)}{4b\left(a+bx^2\right)^2}$$

input
```
Int[(x*Sin[c + d*x])/(a + b*x^2)^3,x]
```

output
```
-1/4*Sin[c + d*x]/(b*(a + b*x^2)^2) + (d*(-1/4*Cos[c + d*x]/(a*Sqrt[b]*(Sq
rt[-a] - Sqrt[b]*x)) + Cos[c + d*x]/(4*a*Sqrt[b]*(Sqrt[-a] + Sqrt[b]*x)) -
 (Cos[c + (Sqrt[-a]*d)/Sqrt[b]]*CosIntegral[(Sqrt[-a]*d)/Sqrt[b] - d*x])/(
4*(-a)^(3/2)*Sqrt[b]) + (Cos[c - (Sqrt[-a]*d)/Sqrt[b]]*CosIntegral[(Sqrt[-
a]*d)/Sqrt[b] + d*x])/(4*(-a)^(3/2)*Sqrt[b]) + (d*CosIntegral[(Sqrt[-a]*d)
/Sqrt[b] + d*x]*Sin[c - (Sqrt[-a]*d)/Sqrt[b]])/(4*a*b) + (d*CosIntegral[(S
qrt[-a]*d)/Sqrt[b] - d*x]*Sin[c + (Sqrt[-a]*d)/Sqrt[b]])/(4*a*b) - (d*Cos[
c + (Sqrt[-a]*d)/Sqrt[b]]*SinIntegral[(Sqrt[-a]*d)/Sqrt[b] - d*x])/(4*a*b)
 - (Sin[c + (Sqrt[-a]*d)/Sqrt[b]]*SinIntegral[(Sqrt[-a]*d)/Sqrt[b] - d*x])
/(4*(-a)^(3/2)*Sqrt[b]) + (d*Cos[c - (Sqrt[-a]*d)/Sqrt[b]]*SinIntegral[(Sq
rt[-a]*d)/Sqrt[b] + d*x])/(4*a*b) - (Sin[c - (Sqrt[-a]*d)/Sqrt[b]]*SinInte
gral[(Sqrt[-a]*d)/Sqrt[b] + d*x])/(4*(-a)^(3/2)*Sqrt[b])))/(4*b)
```

#### 3.74.3.1 Defintions of rubi rules used

rule 2009
```
Int[u_, x_Symbol] :> Simp[IntSum[u, x], x] /; SumQ[u]
```

rule 3815
```
Int[Cos[(c_.) + (d_.)*(x_)]*((a_) + (b_.)*(x_)^(n_))^(p_), x_Symbol] :> Int
[ExpandIntegrand[Cos[c + d*x], (a + b*x^n)^p, x], x] /; FreeQ[{a, b, c, d},
 x] && ILtQ[p, 0] && IGtQ[n, 0] && (EqQ[n, 2] || EqQ[p, -1])
```

rule 3822
```
Int[((e_.)*(x_))^(m_.)*((a_) + (b_.)*(x_)^(n_))^(p_)*Sin[(c_.) + (d_.)*(x_)
], x_Symbol] :> Simp[e^m*(a + b*x^n)^(p + 1)*(Sin[c + d*x]/(b*n*(p + 1))),
x] - Simp[d*(e^m/(b*n*(p + 1)))   Int[(a + b*x^n)^(p + 1)*Cos[c + d*x], x],
 x] /; FreeQ[{a, b, c, d, e, m, n}, x] && ILtQ[p, -1] && EqQ[m, n - 1] && (
IntegerQ[n] || GtQ[e, 0])
```

### 3.74.4 Maple [C] (verified)

Result contains complex when optimal does not.

Time = 0.68 (sec) , antiderivative size = 628, normalized size of antiderivative = 1.23

| method | result |
|---|---|
| risch | $\frac{i d^{2} \mathrm{e}^{\frac{icb+d\sqrt{ab}}{b}} \mathrm{Ei}_{1}\left(\frac{icb+d\sqrt{ab}-b(idx+ic)}{b}\right)}{32a\,b^{2}}+\frac{i d^{2} \mathrm{e}^{\frac{icb-d\sqrt{ab}}{b}} \mathrm{Ei}_{1}\left(-\frac{-icb+d\sqrt{ab}+b(idx+ic)}{b}\right)}{32a\,b^{2}}-\frac{i d\,\mathrm{e}^{\frac{icb+d\sqrt{ab}}{b}} \sqrt{ab}\,\mathrm{Ei}_{1}\left(\frac{ic}{}\right.}{32a^{2}b^{2}}$ |
| derivativedivides | Expression too large to display |
| default | Expression too large to display |

input
```
int(x*sin(d*x+c)/(b*x^2+a)^3,x,method=_RETURNVERBOSE)
```

output
```
1/32*I*d^2/a/b^2*exp((I*c*b+d*(a*b)^(1/2))/b)*Ei(1,(I*c*b+d*(a*b)^(1/2)-b*
(I*d*x+I*c))/b)+1/32*I*d^2/a/b^2*exp((I*c*b-d*(a*b)^(1/2))/b)*Ei(1,-(-I*c*
b+d*(a*b)^(1/2)+b*(I*d*x+I*c))/b)-1/32*I*d/a^2/b^2*exp((I*c*b+d*(a*b)^(1/2
))/b)*(a*b)^(1/2)*Ei(1,(I*c*b+d*(a*b)^(1/2)-b*(I*d*x+I*c))/b)+1/32*I*d/a^2
/b^2*(a*b)^(1/2)*exp((I*c*b-d*(a*b)^(1/2))/b)*Ei(1,-(-I*c*b+d*(a*b)^(1/2)+
b*(I*d*x+I*c))/b)-1/32*I*d^2/a/b^2*exp(-(I*c*b-d*(a*b)^(1/2))/b)*Ei(1,(-I*
c*b+d*(a*b)^(1/2)+b*(I*d*x+I*c))/b)-1/32*I*d^2/a/b^2*Ei(1,-(I*c*b+d*(a*b)^
(1/2)-b*(I*d*x+I*c))/b)*exp(-(I*c*b+d*(a*b)^(1/2))/b)+1/32*I*d/a^2/b^2*(a*
b)^(1/2)*exp(-(I*c*b-d*(a*b)^(1/2))/b)*Ei(1,(-I*c*b+d*(a*b)^(1/2)+b*(I*d*x
+I*c))/b)-1/32*I*d/a^2/b^2*(a*b)^(1/2)*Ei(1,-(I*c*b+d*(a*b)^(1/2)-b*(I*d*x
+I*c))/b)*exp(-(I*c*b+d*(a*b)^(1/2))/b)-1/8*d^3/a*x*(b*d^2*x^2+a*d^2)/b/(-
b^2*d^4*x^4-2*a*b*d^4*x^2-a^2*d^4)*cos(d*x+c)+1/4*d^4/b/(-b^2*d^4*x^4-2*a*
b*d^4*x^2-a^2*d^4)*sin(d*x+c)
```

### 3.74.5 Fricas [C] (verification not implemented)

Result contains complex when optimal does not.

Time = 0.32 (sec) , antiderivative size = 483, normalized size of antiderivative = 0.94

$$\int \frac{x\sin(c+dx)}{(a+bx^2)^3}\,dx =$$

$$-\frac{8\,a^2b\sin\left(dx+c\right)+\left(i\,ab^2d^2x^4+2i\,a^2bd^2x^2+i\,a^3d^2-\left(i\,b^3x^4+2i\,ab^2x^2+i\,a^2b\right)\sqrt{\frac{ad^2}{b}}\right)\mathrm{Ei}\left(i\,dx-\sqrt{\frac{ad^2}{b}}\right.}{}$$

input
```
integrate(x*sin(d*x+c)/(b*x^2+a)^3,x, algorithm="fricas")
```

output
```
-1/32*(8*a^2*b*sin(d*x + c) + (I*a*b^2*d^2*x^4 + 2*I*a^2*b*d^2*x^2 + I*a^3
*d^2 - (I*b^3*x^4 + 2*I*a*b^2*x^2 + I*a^2*b)*sqrt(a*d^2/b))*Ei(I*d*x - sqr
t(a*d^2/b))*e^(I*c + sqrt(a*d^2/b)) + (I*a*b^2*d^2*x^4 + 2*I*a^2*b*d^2*x^2
 + I*a^3*d^2 - (-I*b^3*x^4 - 2*I*a*b^2*x^2 - I*a^2*b)*sqrt(a*d^2/b))*Ei(I*
d*x + sqrt(a*d^2/b))*e^(I*c - sqrt(a*d^2/b)) + (-I*a*b^2*d^2*x^4 - 2*I*a^2
*b*d^2*x^2 - I*a^3*d^2 - (-I*b^3*x^4 - 2*I*a*b^2*x^2 - I*a^2*b)*sqrt(a*d^2
/b))*Ei(-I*d*x - sqrt(a*d^2/b))*e^(-I*c + sqrt(a*d^2/b)) + (-I*a*b^2*d^2*x
^4 - 2*I*a^2*b*d^2*x^2 - I*a^3*d^2 - (I*b^3*x^4 + 2*I*a*b^2*x^2 + I*a^2*b)
*sqrt(a*d^2/b))*Ei(-I*d*x + sqrt(a*d^2/b))*e^(-I*c - sqrt(a*d^2/b)) - 4*(a
*b^2*d*x^3 + a^2*b*d*x)*cos(d*x + c))/(a^2*b^4*x^4 + 2*a^3*b^3*x^2 + a^4*b
^2)
```

## 3.74.6 Sympy [F(-1)]

Timed out.

$$\int \frac{x\sin(c+dx)}{(a+bx^2)^3}\,dx = \text{Timed out}$$

input
```
integrate(x*sin(d*x+c)/(b*x**2+a)**3,x)
```

output
```
Timed out
```

## 3.74.7 Maxima [F]

$$\int \frac{x\sin(c+dx)}{(a+bx^2)^3}\,dx = \int \frac{x\sin(dx+c)}{(bx^2+a)^3}\,dx$$

input
```
integrate(x*sin(d*x+c)/(b*x^2+a)^3,x, algorithm="maxima")
```

output
```
-1/2*((cos(c)^2 + sin(c)^2)*x*cos(d*x + c) + (x*cos(d*x + c)^2*cos(c) + x*
cos(c)*sin(d*x + c)^2)*cos(d*x + 2*c) + 2*(((b^3*cos(c)^2 + b^3*sin(c)^2)*
d*x^6 + 3*(a*b^2*cos(c)^2 + a*b^2*sin(c)^2)*d*x^4 + 3*(a^2*b*cos(c)^2 + a^
2*b*sin(c)^2)*d*x^2 + (a^3*cos(c)^2 + a^3*sin(c)^2)*d)*cos(d*x + c)^2 + ((
b^3*cos(c)^2 + b^3*sin(c)^2)*d*x^6 + 3*(a*b^2*cos(c)^2 + a*b^2*sin(c)^2)*d
*x^4 + 3*(a^2*b*cos(c)^2 + a^2*b*sin(c)^2)*d*x^2 + (a^3*cos(c)^2 + a^3*sin
(c)^2)*d)*sin(d*x + c)^2)*integrate(1/2*(5*b*x^2 - a)*cos(d*x + c)/(b^4*d*
x^8 + 4*a*b^3*d*x^6 + 6*a^2*b^2*d*x^4 + 4*a^3*b*d*x^2 + a^4*d), x) + 2*(((
b^3*cos(c)^2 + b^3*sin(c)^2)*d*x^6 + 3*(a*b^2*cos(c)^2 + a*b^2*sin(c)^2)*d
*x^4 + 3*(a^2*b*cos(c)^2 + a^2*b*sin(c)^2)*d*x^2 + (a^3*cos(c)^2 + a^3*sin
(c)^2)*d)*cos(d*x + c)^2 + ((b^3*cos(c)^2 + b^3*sin(c)^2)*d*x^6 + 3*(a*b^2
*cos(c)^2 + a*b^2*sin(c)^2)*d*x^4 + 3*(a^2*b*cos(c)^2 + a^2*b*sin(c)^2)*d*
x^2 + (a^3*cos(c)^2 + a^3*sin(c)^2)*d)*sin(d*x + c)^2)*integrate(1/2*(5*b*
x^2 - a)*cos(d*x + c)/((b^4*d*x^8 + 4*a*b^3*d*x^6 + 6*a^2*b^2*d*x^4 + 4*a^
3*b*d*x^2 + a^4*d)*cos(d*x + c)^2 + (b^4*d*x^8 + 4*a*b^3*d*x^6 + 6*a^2*b^2
*d*x^4 + 4*a^3*b*d*x^2 + a^4*d)*sin(d*x + c)^2), x) + (x*cos(d*x + c)^2*si
n(c) + x*sin(d*x + c)^2*sin(c))*sin(d*x + 2*c))/(((b^3*cos(c)^2 + b^3*sin(
c)^2)*d*x^6 + 3*(a*b^2*cos(c)^2 + a*b^2*sin(c)^2)*d*x^4 + 3*(a^2*b*cos(c)^
2 + a^2*b*sin(c)^2)*d*x^2 + (a^3*cos(c)^2 + a^3*sin(c)^2)*d)*cos(d*x + c)^
2 + ((b^3*cos(c)^2 + b^3*sin(c)^2)*d*x^6 + 3*(a*b^2*cos(c)^2 + a*b^2*si...
```

### 3.74.8 Giac [F]

$$\int \frac{x\sin(c+dx)}{(a+bx^2)^3}\,dx = \int \frac{x\sin(dx+c)}{(bx^2+a)^3}\,dx$$

input
```
integrate(x*sin(d*x+c)/(b*x^2+a)^3,x, algorithm="giac")
```

output
```
integrate(x*sin(d*x + c)/(b*x^2 + a)^3, x)
```

### 3.74.9 Mupad [F(-1)]

Timed out.

$$\int \frac{x\sin(c+dx)}{(a+bx^2)^3}\,dx = \int \frac{x\,\sin\left(c+d\,x\right)}{\left(b\,x^2+a\right)^3}\,dx$$

input
```
int((x*sin(c + d*x))/(a + b*x^2)^3,x)
```

output
```
int((x*sin(c + d*x))/(a + b*x^2)^3, x)
```

# 3.75 $\int \frac{\sin(c+dx)}{(a+bx^2)^3}\,dx$

### 3.75.1 Optimal result

Integrand size = 16, antiderivative size = 856

$$\int \frac{\sin(c+dx)}{(a+bx^2)^3}\,dx = \frac{d\cos(c+dx)}{16(-a)^{3/2}b\left(\sqrt{-a}-\sqrt{b}x\right)} + \frac{d\cos(c+dx)}{16(-a)^{3/2}b\left(\sqrt{-a}+\sqrt{b}x\right)}$$
$$- \frac{3d\cos\left(c+\frac{\sqrt{-a}d}{\sqrt{b}}\right)\text{CosIntegral}\left(\frac{\sqrt{-a}d}{\sqrt{b}}-dx\right)}{16a^2b}$$
$$- \frac{3d\cos\left(c-\frac{\sqrt{-a}d}{\sqrt{b}}\right)\text{CosIntegral}\left(\frac{\sqrt{-a}d}{\sqrt{b}}+dx\right)}{16a^2b}$$
$$- \frac{3\,\text{CosIntegral}\left(\frac{\sqrt{-a}d}{\sqrt{b}}+dx\right)\sin\left(c-\frac{\sqrt{-a}d}{\sqrt{b}}\right)}{16(-a)^{5/2}\sqrt{b}}$$
$$+ \frac{d^2\,\text{CosIntegral}\left(\frac{\sqrt{-a}d}{\sqrt{b}}+dx\right)\sin\left(c-\frac{\sqrt{-a}d}{\sqrt{b}}\right)}{16(-a)^{3/2}b^{3/2}}$$
$$+ \frac{3\,\text{CosIntegral}\left(\frac{\sqrt{-a}d}{\sqrt{b}}-dx\right)\sin\left(c+\frac{\sqrt{-a}d}{\sqrt{b}}\right)}{16(-a)^{5/2}\sqrt{b}}$$
$$- \frac{d^2\,\text{CosIntegral}\left(\frac{\sqrt{-a}d}{\sqrt{b}}-dx\right)\sin\left(c+\frac{\sqrt{-a}d}{\sqrt{b}}\right)}{16(-a)^{3/2}b^{3/2}}$$
$$- \frac{\sin(c+dx)}{16(-a)^{3/2}\sqrt{b}\left(\sqrt{-a}-\sqrt{b}x\right)^2} - \frac{3\sin(c+dx)}{16a^2\sqrt{b}\left(\sqrt{-a}-\sqrt{b}x\right)}$$
$$+ \frac{\sin(c+dx)}{16(-a)^{3/2}\sqrt{b}\left(\sqrt{-a}+\sqrt{b}x\right)^2} + \frac{3\sin(c+dx)}{16a^2\sqrt{b}\left(\sqrt{-a}+\sqrt{b}x\right)}$$
$$- \frac{3\cos\left(c+\frac{\sqrt{-a}d}{\sqrt{b}}\right)\text{Si}\left(\frac{\sqrt{-a}d}{\sqrt{b}}-dx\right)}{16(-a)^{5/2}\sqrt{b}} + \frac{d^2\cos\left(c+\frac{\sqrt{-a}d}{\sqrt{b}}\right)\text{Si}\left(\frac{\sqrt{-a}d}{\sqrt{b}}-dx\right)}{16(-a)^{3/2}b^{3/2}}$$
$$- \frac{3d\sin\left(c+\frac{\sqrt{-a}d}{\sqrt{b}}\right)\text{Si}\left(\frac{\sqrt{-a}d}{\sqrt{b}}-dx\right)}{16a^2b} - \frac{3\cos\left(c-\frac{\sqrt{-a}d}{\sqrt{b}}\right)\text{Si}\left(\frac{\sqrt{-a}d}{\sqrt{b}}+dx\right)}{16(-a)^{5/2}\sqrt{b}}$$
$$+ \frac{d^2\cos\left(c-\frac{\sqrt{-a}d}{\sqrt{b}}\right)\text{Si}\left(\frac{\sqrt{-a}d}{\sqrt{b}}+dx\right)}{16(-a)^{3/2}b^{3/2}}$$
$$+ \frac{3d\sin\left(c-\frac{\sqrt{-a}d}{\sqrt{b}}\right)\text{Si}\left(\frac{\sqrt{-a}d}{\sqrt{b}}+dx\right)}{16a^2b}$$

output
```
-3/16*d*Ci(d*x+d*(-a)^(1/2)/b^(1/2))*cos(c-d*(-a)^(1/2)/b^(1/2))/a^2/b-3/1
6*d*Ci(-d*x+d*(-a)^(1/2)/b^(1/2))*cos(c+d*(-a)^(1/2)/b^(1/2))/a^2/b-1/16*d
^2*cos(c+d*(-a)^(1/2)/b^(1/2))*Si(d*x-d*(-a)^(1/2)/b^(1/2))/(-a)^(3/2)/b^(
3/2)+1/16*d^2*cos(c-d*(-a)^(1/2)/b^(1/2))*Si(d*x+d*(-a)^(1/2)/b^(1/2))/(-a
)^(3/2)/b^(3/2)+1/16*d^2*Ci(d*x+d*(-a)^(1/2)/b^(1/2))*sin(c-d*(-a)^(1/2)/b
^(1/2))/(-a)^(3/2)/b^(3/2)+3/16*d*Si(d*x+d*(-a)^(1/2)/b^(1/2))*sin(c-d*(-a
)^(1/2)/b^(1/2))/a^2/b-1/16*d^2*Ci(-d*x+d*(-a)^(1/2)/b^(1/2))*sin(c+d*(-a)
^(1/2)/b^(1/2))/(-a)^(3/2)/b^(3/2)+3/16*d*Si(d*x-d*(-a)^(1/2)/b^(1/2))*sin
(c+d*(-a)^(1/2)/b^(1/2))/a^2/b+3/16*cos(c+d*(-a)^(1/2)/b^(1/2))*Si(d*x-d*(
-a)^(1/2)/b^(1/2))/(-a)^(5/2)/b^(1/2)-3/16*cos(c-d*(-a)^(1/2)/b^(1/2))*Si(
d*x+d*(-a)^(1/2)/b^(1/2))/(-a)^(5/2)/b^(1/2)-3/16*Ci(d*x+d*(-a)^(1/2)/b^(1
/2))*sin(c-d*(-a)^(1/2)/b^(1/2))/(-a)^(5/2)/b^(1/2)+3/16*Ci(-d*x+d*(-a)^(1
/2)/b^(1/2))*sin(c+d*(-a)^(1/2)/b^(1/2))/(-a)^(5/2)/b^(1/2)-1/16*sin(d*x+c
)/(-a)^(3/2)/b^(1/2)/((-a)^(1/2)-x*b^(1/2))^2+1/16*d*cos(d*x+c)/(-a)^(3/2)
/b/((-a)^(1/2)-x*b^(1/2))-3/16*sin(d*x+c)/a^2/b^(1/2)/((-a)^(1/2)-x*b^(1/2
))+1/16*sin(d*x+c)/(-a)^(3/2)/b^(1/2)/((-a)^(1/2)+x*b^(1/2))^2+1/16*d*cos(
d*x+c)/(-a)^(3/2)/b/((-a)^(1/2)+x*b^(1/2))+3/16*sin(d*x+c)/a^2/b^(1/2)/((-
a)^(1/2)+x*b^(1/2))
```

### 3.75.2 Mathematica [C] (verified)

Result contains complex when optimal does not.

Time = 2.99 (sec) , antiderivative size = 374, normalized size of antiderivative = 0.44

$$\int \frac{\sin(c+dx)}{(a+bx^2)^3}\,dx$$
$$= \frac{e^{-ic-\frac{\sqrt{a}d}{\sqrt{b}}}\left(\left(3b-3\sqrt{a}\sqrt{b}d+ad^2\right)e^{\frac{2\sqrt{a}d}{\sqrt{b}}}\text{ExpIntegralEi}\left(-\frac{\sqrt{a}d}{\sqrt{b}}-idx\right)-\left(3b+3\sqrt{a}\sqrt{b}d+ad^2\right)\text{ExpIntegr}\right.}{}$$

input
```
Integrate[Sin[c + d*x]/(a + b*x^2)^3,x]
```

output
```
(E^((-I)*c - (Sqrt[a]*d)/Sqrt[b])*((3*b - 3*Sqrt[a]*Sqrt[b]*d + a*d^2)*E^(
(2*Sqrt[a]*d)/Sqrt[b])*ExpIntegralEi[-((Sqrt[a]*d)/Sqrt[b]) - I*d*x] - (3*
b + 3*Sqrt[a]*Sqrt[b]*d + a*d^2)*ExpIntegralEi[(Sqrt[a]*d)/Sqrt[b] - I*d*x
]) + E^(I*c - (Sqrt[a]*d)/Sqrt[b])*((3*b - 3*Sqrt[a]*Sqrt[b]*d + a*d^2)*E^
((2*Sqrt[a]*d)/Sqrt[b])*ExpIntegralEi[-((Sqrt[a]*d)/Sqrt[b]) + I*d*x] - (3
*b + 3*Sqrt[a]*Sqrt[b]*d + a*d^2)*ExpIntegralEi[(Sqrt[a]*d)/Sqrt[b] + I*d*
x]) + (4*Sqrt[a]*Sqrt[b]*Cos[d*x]*(a*d*(a + b*x^2)*Cos[c] + b*x*(5*a + 3*b
*x^2)*Sin[c]))/(a + b*x^2)^2 - (4*Sqrt[a]*Sqrt[b]*(-(b*x*(5*a + 3*b*x^2)*C
os[c]) + a*d*(a + b*x^2)*Sin[c])*Sin[d*x])/(a + b*x^2)^2)/(32*a^(5/2)*b^(3
/2))
```

### 3.75.3 Rubi [A] (verified)

Time = 1.59 (sec) , antiderivative size = 856, normalized size of antiderivative = 1.00, number of steps used = 2, number of rules used = 2, $\frac{\text{number of rules}}{\text{integrand size}} = 0.125$, Rules used = {3814, 2009}

Below are the steps used by Rubi to obtain the solution. The rule number used for the transformation is given above next to the arrow. The rules definitions used are listed below.

$$\int \frac{\sin(c+dx)}{(a+bx^2)^3}\,dx$$

$$\Big\downarrow \ 3814$$

$$\int \left(-\frac{3b\sin(c+dx)}{8a^2(-ab-b^2x^2)} - \frac{3b\sin(c+dx)}{16a^2\left(\sqrt{-a}\sqrt{b}-bx\right)^2} - \frac{3b\sin(c+dx)}{16a^2\left(\sqrt{-a}\sqrt{b}+bx\right)^2} - \frac{b^{3/2}\sin(c+dx)}{8(-a)^{3/2}\left(\sqrt{-a}\sqrt{b}-bx\right)^3} - \frac{}{8(-a)}\right.$$

$$\Big\downarrow \ 2009$$

$$\frac{\text{CosIntegral}\left(xd+\frac{\sqrt{-a}d}{\sqrt{b}}\right)\sin\left(c-\frac{\sqrt{-a}d}{\sqrt{b}}\right)d^2}{16(-a)^{3/2}b^{3/2}}-\frac{\text{CosIntegral}\left(\frac{\sqrt{-a}d}{\sqrt{b}}-dx\right)\sin\left(c+\frac{\sqrt{-a}d}{\sqrt{b}}\right)d^2}{16(-a)^{3/2}b^{3/2}}+\frac{\cos\left(c+\frac{\sqrt{-a}d}{\sqrt{b}}\right)\text{Si}\left(\frac{\sqrt{-a}d}{\sqrt{b}}-dx\right)d^2}{16(-a)^{3/2}b^{3/2}}+\frac{\cos\left(c-\frac{\sqrt{-a}d}{\sqrt{b}}\right)\text{Si}\left(xd+\frac{\sqrt{-a}d}{\sqrt{b}}\right)d^2}{16(-a)^{3/2}b^{3/2}}+\frac{\cos(c+dx)d}{16(-a)^{3/2}b\left(\sqrt{-a}-\sqrt{b}x\right)}+\frac{\cos(c+dx)d}{16(-a)^{3/2}b\left(\sqrt{b}x+\sqrt{-a}\right)}-\frac{3\cos\left(c+\frac{\sqrt{-a}d}{\sqrt{b}}\right)\text{CosIntegral}\left(\frac{\sqrt{-a}d}{\sqrt{b}}-dx\right)d}{16a^2b}-\frac{3\cos\left(c-\frac{\sqrt{-a}d}{\sqrt{b}}\right)\text{CosIntegral}\left(xd+\frac{\sqrt{-a}d}{\sqrt{b}}\right)d}{16a^2b}-\frac{3\sin\left(c+\frac{\sqrt{-a}d}{\sqrt{b}}\right)\text{Si}\left(\frac{\sqrt{-a}d}{\sqrt{b}}-dx\right)d}{16a^2b}+\frac{3\sin\left(c-\frac{\sqrt{-a}d}{\sqrt{b}}\right)\text{Si}\left(xd+\frac{\sqrt{-a}d}{\sqrt{b}}\right)d}{16a^2b}-\frac{3\,\text{CosIntegral}\left(xd+\frac{\sqrt{-a}d}{\sqrt{b}}\right)\sin\left(c-\frac{\sqrt{-a}d}{\sqrt{b}}\right)}{16(-a)^{5/2}\sqrt{b}}+\frac{3\,\text{CosIntegral}\left(\frac{\sqrt{-a}d}{\sqrt{b}}-dx\right)\sin\left(c+\frac{\sqrt{-a}d}{\sqrt{b}}\right)}{16(-a)^{5/2}\sqrt{b}}-\frac{3\sin(c+dx)}{16a^2\sqrt{b}\left(\sqrt{-a}-\sqrt{b}x\right)}+\frac{3\sin(c+dx)}{16a^2\sqrt{b}\left(\sqrt{b}x+\sqrt{-a}\right)}-\frac{\sin(c+dx)}{16(-a)^{3/2}\sqrt{b}\left(\sqrt{-a}-\sqrt{b}x\right)^2}+\frac{\sin(c+dx)}{16(-a)^{3/2}\sqrt{b}\left(\sqrt{b}x+\sqrt{-a}\right)^2}-\frac{3\cos\left(c+\frac{\sqrt{-a}d}{\sqrt{b}}\right)\text{Si}\left(\frac{\sqrt{-a}d}{\sqrt{b}}-dx\right)}{16(-a)^{5/2}\sqrt{b}}-\frac{3\cos\left(c-\frac{\sqrt{-a}d}{\sqrt{b}}\right)\text{Si}\left(xd+\frac{\sqrt{-a}d}{\sqrt{b}}\right)}{16(-a)^{5/2}\sqrt{b}}$$

input
```
Int[Sin[c + d*x]/(a + b*x^2)^3,x]
```

3.75. $\int \frac{\sin(c+dx)}{(a+bx^2)^3}\,dx$

output
```
(d*Cos[c + d*x])/(16*(-a)^(3/2)*b*(Sqrt[-a] - Sqrt[b]*x)) + (d*Cos[c + d*x
])/(16*(-a)^(3/2)*b*(Sqrt[-a] + Sqrt[b]*x)) - (3*d*Cos[c + (Sqrt[-a]*d)/Sq
rt[b]]*CosIntegral[(Sqrt[-a]*d)/Sqrt[b] - d*x])/(16*a^2*b) - (3*d*Cos[c -
(Sqrt[-a]*d)/Sqrt[b]]*CosIntegral[(Sqrt[-a]*d)/Sqrt[b] + d*x])/(16*a^2*b)
- (3*CosIntegral[(Sqrt[-a]*d)/Sqrt[b] + d*x]*Sin[c - (Sqrt[-a]*d)/Sqrt[b]]
)/(16*(-a)^(5/2)*Sqrt[b]) + (d^2*CosIntegral[(Sqrt[-a]*d)/Sqrt[b] + d*x]*S
in[c - (Sqrt[-a]*d)/Sqrt[b]])/(16*(-a)^(3/2)*b^(3/2)) + (3*CosIntegral[(Sq
rt[-a]*d)/Sqrt[b] - d*x]*Sin[c + (Sqrt[-a]*d)/Sqrt[b]])/(16*(-a)^(5/2)*Sqr
t[b]) - (d^2*CosIntegral[(Sqrt[-a]*d)/Sqrt[b] - d*x]*Sin[c + (Sqrt[-a]*d)/
Sqrt[b]])/(16*(-a)^(3/2)*b^(3/2)) - Sin[c + d*x]/(16*(-a)^(3/2)*Sqrt[b]*(S
qrt[-a] - Sqrt[b]*x)^2) - (3*Sin[c + d*x])/(16*a^2*Sqrt[b]*(Sqrt[-a] - Sqr
t[b]*x)) + Sin[c + d*x]/(16*(-a)^(3/2)*Sqrt[b]*(Sqrt[-a] + Sqrt[b]*x)^2) +
 (3*Sin[c + d*x])/(16*a^2*Sqrt[b]*(Sqrt[-a] + Sqrt[b]*x)) - (3*Cos[c + (Sq
rt[-a]*d)/Sqrt[b]]*SinIntegral[(Sqrt[-a]*d)/Sqrt[b] - d*x])/(16*(-a)^(5/2)
*Sqrt[b]) + (d^2*Cos[c + (Sqrt[-a]*d)/Sqrt[b]]*SinIntegral[(Sqrt[-a]*d)/Sq
rt[b] - d*x])/(16*(-a)^(3/2)*b^(3/2)) - (3*d*Sin[c + (Sqrt[-a]*d)/Sqrt[b]]
*SinIntegral[(Sqrt[-a]*d)/Sqrt[b] - d*x])/(16*a^2*b) - (3*Cos[c - (Sqrt[-a
]*d)/Sqrt[b]]*SinIntegral[(Sqrt[-a]*d)/Sqrt[b] + d*x])/(16*(-a)^(5/2)*Sqrt
[b]) + (d^2*Cos[c - (Sqrt[-a]*d)/Sqrt[b]]*SinIntegral[(Sqrt[-a]*d)/Sqrt[b]
 + d*x])/(16*(-a)^(3/2)*b^(3/2)) + (3*d*Sin[c - (Sqrt[-a]*d)/Sqrt[b]]*S...
```

### 3.75.3.1 Defintions of rubi rules used

rule 2009
```
Int[u_, x_Symbol] :> Simp[IntSum[u, x], x] /; SumQ[u]
```

rule 3814
```
Int[((a_) + (b_.)*(x_)^(n_))^(p_)*Sin[(c_.) + (d_.)*(x_)], x_Symbol] :> Int
[ExpandIntegrand[Sin[c + d*x], (a + b*x^n)^p, x], x] /; FreeQ[{a, b, c, d},
 x] && ILtQ[p, 0] && IGtQ[n, 0] && (EqQ[n, 2] || EqQ[p, -1])
```

### 3.75.4 Maple [A] (verified)

Time = 0.52 (sec) , antiderivative size = 598, normalized size of antiderivative = 0.70

| method | result |
|---|---|
| derivativedivides | $d^5\left(-\frac{\sin(dx+c)\left(5ac\,d^2-5a\,d^2(dx+c)+3c^3b-9b\,c^2(dx+c)+9bc(dx+c)^2-3b(dx+c)^3\right)}{8a^2d^4\left(a\,d^2+c^2b-2bc(dx+c)+b(dx+c)^2\right)^2}+\frac{\cos(dx+c)}{8ab\,d^2\left(a\,d^2+c^2b-2bc(dx+\right.}\right.$ |
| default | $d^5\left(-\frac{\sin(dx+c)\left(5ac\,d^2-5a\,d^2(dx+c)+3c^3b-9b\,c^2(dx+c)+9bc(dx+c)^2-3b(dx+c)^3\right)}{8a^2d^4\left(a\,d^2+c^2b-2bc(dx+c)+b(dx+c)^2\right)^2}+\frac{\cos(dx+c)}{8ab\,d^2\left(a\,d^2+c^2b-2bc(dx+\right.}\right.$ |
| risch | $-\frac{d^2\sqrt{ab}\,e^{\frac{icb+d\sqrt{ab}}{b}}\operatorname{Ei}_1\left(\frac{icb+d\sqrt{ab}-b(idx+ic)}{b}\right)}{32a^2b^2}+\frac{d^2\sqrt{ab}\,e^{\frac{icb-d\sqrt{ab}}{b}}\operatorname{Ei}_1\left(\frac{icb-d\sqrt{ab}-b(idx+ic)}{b}\right)}{32a^2b^2}+\frac{3d\,e^{\frac{icb+d\sqrt{ab}}{b}}\operatorname{Ei}_1\left(\right.}{3}$ |

input

```
int(sin(d*x+c)/(b*x^2+a)^3,x,method=_RETURNVERBOSE)
```

output

```
d^5*(-1/8*sin(d*x+c)*(5*a*c*d^2-5*a*d^2*(d*x+c)+3*c^3*b-9*b*c^2*(d*x+c)+9*
b*c*(d*x+c)^2-3*b*(d*x+c)^3)/a^2/d^4/(a*d^2+c^2*b-2*b*c*(d*x+c)+b*(d*x+c)^
2)^2+1/8*cos(d*x+c)/a/b/d^2/(a*d^2+c^2*b-2*b*c*(d*x+c)+b*(d*x+c)^2)-1/16*(
a*d^2+3*b)/a^2/d^4/b^2/(-(d*(-a*b)^(1/2)+c*b)/b+c)*(Si(d*x+c-(d*(-a*b)^(1/
2)+c*b)/b)*cos((d*(-a*b)^(1/2)+c*b)/b)+Ci(d*x+c-(d*(-a*b)^(1/2)+c*b)/b)*si
n((d*(-a*b)^(1/2)+c*b)/b))-1/16*(a*d^2+3*b)/a^2/d^4/b^2/((d*(-a*b)^(1/2)-c
*b)/b+c)*(Si(d*x+c+(d*(-a*b)^(1/2)-c*b)/b)*cos((d*(-a*b)^(1/2)-c*b)/b)-Ci(
d*x+c+(d*(-a*b)^(1/2)-c*b)/b)*sin((d*(-a*b)^(1/2)-c*b)/b))-3/16/a^2/d^4/b*
(-Si(d*x+c-(d*(-a*b)^(1/2)+c*b)/b)*sin((d*(-a*b)^(1/2)+c*b)/b)+Ci(d*x+c-(d
*(-a*b)^(1/2)+c*b)/b)*cos((d*(-a*b)^(1/2)+c*b)/b))-3/16/a^2/d^4/b*(Si(d*x+
c+(d*(-a*b)^(1/2)-c*b)/b)*sin((d*(-a*b)^(1/2)-c*b)/b)+Ci(d*x+c+(d*(-a*b)^(
1/2)-c*b)/b)*cos((d*(-a*b)^(1/2)-c*b)/b)))
```

### 3.75.5 Fricas [C] (verification not implemented)

Result contains complex when optimal does not.

Time = 0.30 (sec) , antiderivative size = 611, normalized size of antiderivative = 0.71

$$\int \frac{\sin(c+dx)}{(a+bx^2)^3}\,dx =$$

$$-\frac{\left(3\,ab^2d^2x^4+6\,a^2bd^2x^2+3\,a^3d^2-(a^3d^2+(ab^2d^2+3\,b^3)x^4+3\,a^2b+2\,(a^2bd^2+3\,ab^2)x^2)\sqrt{\frac{ad^2}{b}}\right)\operatorname{Ei}\left(i\,c\right.}{}$$

input
```
integrate(sin(d*x+c)/(b*x^2+a)^3,x, algorithm="fricas")
```

output
```
-1/32*((3*a*b^2*d^2*x^4 + 6*a^2*b*d^2*x^2 + 3*a^3*d^2 - (a^3*d^2 + (a*b^2*
d^2 + 3*b^3)*x^4 + 3*a^2*b + 2*(a^2*b*d^2 + 3*a*b^2)*x^2)*sqrt(a*d^2/b))*E
i(I*d*x - sqrt(a*d^2/b))*e^(I*c + sqrt(a*d^2/b)) + (3*a*b^2*d^2*x^4 + 6*a^
2*b*d^2*x^2 + 3*a^3*d^2 + (a^3*d^2 + (a*b^2*d^2 + 3*b^3)*x^4 + 3*a^2*b + 2
*(a^2*b*d^2 + 3*a*b^2)*x^2)*sqrt(a*d^2/b))*Ei(I*d*x + sqrt(a*d^2/b))*e^(I*
c - sqrt(a*d^2/b)) + (3*a*b^2*d^2*x^4 + 6*a^2*b*d^2*x^2 + 3*a^3*d^2 - (a^3
*d^2 + (a*b^2*d^2 + 3*b^3)*x^4 + 3*a^2*b + 2*(a^2*b*d^2 + 3*a*b^2)*x^2)*sq
rt(a*d^2/b))*Ei(-I*d*x - sqrt(a*d^2/b))*e^(-I*c + sqrt(a*d^2/b)) + (3*a*b^
2*d^2*x^4 + 6*a^2*b*d^2*x^2 + 3*a^3*d^2 + (a^3*d^2 + (a*b^2*d^2 + 3*b^3)*x
^4 + 3*a^2*b + 2*(a^2*b*d^2 + 3*a*b^2)*x^2)*sqrt(a*d^2/b))*Ei(-I*d*x + sqr
t(a*d^2/b))*e^(-I*c - sqrt(a*d^2/b)) - 4*(a^2*b*d^2*x^2 + a^3*d^2)*cos(d*x
 + c) - 4*(3*a*b^2*d*x^3 + 5*a^2*b*d*x)*sin(d*x + c))/(a^3*b^3*d*x^4 + 2*a
^4*b^2*d*x^2 + a^5*b*d)
```

### 3.75.6 Sympy [F(-1)]

Timed out.

$$\int \frac{\sin(c+dx)}{(a+bx^2)^3}\,dx = \text{Timed out}$$

input
```
integrate(sin(d*x+c)/(b*x**2+a)**3,x)
```

output
```
Timed out
```

### 3.75.7 Maxima [F]

$$\int \frac{\sin(c+dx)}{(a+bx^2)^3}\,dx = \int \frac{\sin(dx+c)}{(bx^2+a)^3}\,dx$$

input
```
integrate(sin(d*x+c)/(b*x^2+a)^3,x, algorithm="maxima")
```

output
```
integrate(sin(d*x + c)/(b*x^2 + a)^3, x)
```

### 3.75.8 Giac [F]

$$\int \frac{\sin(c+dx)}{(a+bx^2)^3}\,dx = \int \frac{\sin(dx+c)}{(bx^2+a)^3}\,dx$$

input
```
integrate(sin(d*x+c)/(b*x^2+a)^3,x, algorithm="giac")
```

output
```
integrate(sin(d*x + c)/(b*x^2 + a)^3, x)
```

### 3.75.9 Mupad [F(-1)]

Timed out.

$$\int \frac{\sin(c+dx)}{(a+bx^2)^3}\,dx = \int \frac{\sin(c+d\,x)}{(b\,x^2+a)^3}\,dx$$

input
```
int(sin(c + d*x)/(a + b*x^2)^3,x)
```

output
```
int(sin(c + d*x)/(a + b*x^2)^3, x)
```

# 3.76 $\int \frac{\sin(c+dx)}{x(a+bx^2)^3}\,dx$

### 3.76.1 Optimal result

Integrand size = 19, antiderivative size = 730

$$\int \frac{\sin(c+dx)}{x\left(a+bx^2\right)^3}\,dx = \frac{d\cos(c+dx)}{16a^2\sqrt{b}\left(\sqrt{-a}-\sqrt{b}x\right)} - \frac{d\cos(c+dx)}{16a^2\sqrt{b}\left(\sqrt{-a}+\sqrt{b}x\right)}$$
$$-\frac{5d\cos\left(c+\frac{\sqrt{-a}d}{\sqrt{b}}\right)\text{CosIntegral}\left(\frac{\sqrt{-a}d}{\sqrt{b}}-dx\right)}{16(-a)^{5/2}\sqrt{b}}$$
$$+\frac{5d\cos\left(c-\frac{\sqrt{-a}d}{\sqrt{b}}\right)\text{CosIntegral}\left(\frac{\sqrt{-a}d}{\sqrt{b}}+dx\right)}{16(-a)^{5/2}\sqrt{b}}$$
$$+\frac{\text{CosIntegral}(dx)\sin(c)}{a^3} - \frac{\text{CosIntegral}\left(\frac{\sqrt{-a}d}{\sqrt{b}}+dx\right)\sin\left(c-\frac{\sqrt{-a}d}{\sqrt{b}}\right)}{2a^3}$$
$$-\frac{d^2\,\text{CosIntegral}\left(\frac{\sqrt{-a}d}{\sqrt{b}}+dx\right)\sin\left(c-\frac{\sqrt{-a}d}{\sqrt{b}}\right)}{16a^2b}$$
$$-\frac{\text{CosIntegral}\left(\frac{\sqrt{-a}d}{\sqrt{b}}-dx\right)\sin\left(c+\frac{\sqrt{-a}d}{\sqrt{b}}\right)}{2a^3}$$
$$-\frac{d^2\,\text{CosIntegral}\left(\frac{\sqrt{-a}d}{\sqrt{b}}-dx\right)\sin\left(c+\frac{\sqrt{-a}d}{\sqrt{b}}\right)}{16a^2b}$$
$$+\frac{\sin(c+dx)}{4a\left(a+bx^2\right)^2} + \frac{\sin(c+dx)}{2a^2\left(a+bx^2\right)} + \frac{\cos(c)\text{Si}(dx)}{a^3}$$
$$+\frac{\cos\left(c+\frac{\sqrt{-a}d}{\sqrt{b}}\right)\text{Si}\left(\frac{\sqrt{-a}d}{\sqrt{b}}-dx\right)}{2a^3} + \frac{d^2\cos\left(c+\frac{\sqrt{-a}d}{\sqrt{b}}\right)\text{Si}\left(\frac{\sqrt{-a}d}{\sqrt{b}}-dx\right)}{16a^2b}$$
$$-\frac{5d\sin\left(c+\frac{\sqrt{-a}d}{\sqrt{b}}\right)\text{Si}\left(\frac{\sqrt{-a}d}{\sqrt{b}}-dx\right)}{16(-a)^{5/2}\sqrt{b}} - \frac{\cos\left(c-\frac{\sqrt{-a}d}{\sqrt{b}}\right)\text{Si}\left(\frac{\sqrt{-a}d}{\sqrt{b}}+dx\right)}{2a^3}$$
$$-\frac{d^2\cos\left(c-\frac{\sqrt{-a}d}{\sqrt{b}}\right)\text{Si}\left(\frac{\sqrt{-a}d}{\sqrt{b}}+dx\right)}{16a^2b}$$
$$-\frac{5d\sin\left(c-\frac{\sqrt{-a}d}{\sqrt{b}}\right)\text{Si}\left(\frac{\sqrt{-a}d}{\sqrt{b}}+dx\right)}{16(-a)^{5/2}\sqrt{b}}$$

output
```
cos(c)*Si(d*x)/a^3-1/2*cos(c+d*(-a)^(1/2)/b^(1/2))*Si(d*x-d*(-a)^(1/2)/b^(
1/2))/a^3-1/16*d^2*cos(c+d*(-a)^(1/2)/b^(1/2))*Si(d*x-d*(-a)^(1/2)/b^(1/2)
)/a^2/b-1/2*cos(c-d*(-a)^(1/2)/b^(1/2))*Si(d*x+d*(-a)^(1/2)/b^(1/2))/a^3-1
/16*d^2*cos(c-d*(-a)^(1/2)/b^(1/2))*Si(d*x+d*(-a)^(1/2)/b^(1/2))/a^2/b+Ci(
d*x)*sin(c)/a^3+1/4*sin(d*x+c)/a/(b*x^2+a)^2+1/2*sin(d*x+c)/a^2/(b*x^2+a)-
1/2*Ci(d*x+d*(-a)^(1/2)/b^(1/2))*sin(c-d*(-a)^(1/2)/b^(1/2))/a^3-1/16*d^2*
Ci(d*x+d*(-a)^(1/2)/b^(1/2))*sin(c-d*(-a)^(1/2)/b^(1/2))/a^2/b-1/2*Ci(-d*x
+d*(-a)^(1/2)/b^(1/2))*sin(c+d*(-a)^(1/2)/b^(1/2))/a^3-1/16*d^2*Ci(-d*x+d*
(-a)^(1/2)/b^(1/2))*sin(c+d*(-a)^(1/2)/b^(1/2))/a^2/b+5/16*d*Ci(d*x+d*(-a)
^(1/2)/b^(1/2))*cos(c-d*(-a)^(1/2)/b^(1/2))/(-a)^(5/2)/b^(1/2)-5/16*d*Ci(-
d*x+d*(-a)^(1/2)/b^(1/2))*cos(c+d*(-a)^(1/2)/b^(1/2))/(-a)^(5/2)/b^(1/2)-5
/16*d*Si(d*x+d*(-a)^(1/2)/b^(1/2))*sin(c-d*(-a)^(1/2)/b^(1/2))/(-a)^(5/2)/
b^(1/2)+5/16*d*Si(d*x-d*(-a)^(1/2)/b^(1/2))*sin(c+d*(-a)^(1/2)/b^(1/2))/(-
a)^(5/2)/b^(1/2)+1/16*d*cos(d*x+c)/a^2/b^(1/2)/((-a)^(1/2)-x*b^(1/2))-1/16
*d*cos(d*x+c)/a^2/b^(1/2)/((-a)^(1/2)+x*b^(1/2))
```

### 3.76.2 Mathematica [C] (verified)

Result contains complex when optimal does not.

Time = 2.36 (sec) , antiderivative size = 672, normalized size of antiderivative = 0.92

$$\int \frac{\sin(c+dx)}{x(a+bx^2)^3}\,dx$$

$$= \frac{-\frac{4adx\cos(c+dx)}{a+bx^2} + \frac{4i\sqrt{a}de^{-ic-\frac{\sqrt{a}d}{\sqrt{b}}}\left(e^{\frac{2\sqrt{a}d}{\sqrt{b}}}\text{ExpIntegralEi}\left(-\frac{\sqrt{a}d}{\sqrt{b}}-idx\right)-\text{ExpIntegralEi}\left(\frac{\sqrt{a}d}{\sqrt{b}}-idx\right)\right)}{\sqrt{b}} - 8ie^{-ic-\frac{\sqrt{a}d}{\sqrt{b}}}\left(e^{\frac{2\sqrt{a}d}{\sqrt{b}}}\text{ExpI}\right.}{}$$

input
```
Integrate[Sin[c + d*x]/(x*(a + b*x^2)^3),x]
```

output
```
((-4*a*d*x*Cos[c + d*x])/(a + b*x^2) + ((4*I)*Sqrt[a]*d*E^((-I)*c - (Sqrt[
a]*d)/Sqrt[b])*(E^((2*Sqrt[a]*d)/Sqrt[b])*ExpIntegralEi[-((Sqrt[a]*d)/Sqrt
[b]) - I*d*x] - ExpIntegralEi[(Sqrt[a]*d)/Sqrt[b] - I*d*x]))/Sqrt[b] - (8*
I)*E^((-I)*c - (Sqrt[a]*d)/Sqrt[b])*(E^((2*Sqrt[a]*d)/Sqrt[b])*ExpIntegral
Ei[-((Sqrt[a]*d)/Sqrt[b]) - I*d*x] + ExpIntegralEi[(Sqrt[a]*d)/Sqrt[b] - I
*d*x]) - (I*Sqrt[a]*d*E^((-I)*c - (Sqrt[a]*d)/Sqrt[b])*(-((Sqrt[b] - Sqrt[
a]*d)*E^((2*Sqrt[a]*d)/Sqrt[b])*ExpIntegralEi[-((Sqrt[a]*d)/Sqrt[b]) - I*d
*x]) + (Sqrt[b] + Sqrt[a]*d)*ExpIntegralEi[(Sqrt[a]*d)/Sqrt[b] - I*d*x]))/
b - ((4*I)*Sqrt[a]*d*E^(I*c - (Sqrt[a]*d)/Sqrt[b])*(E^((2*Sqrt[a]*d)/Sqrt[
b])*ExpIntegralEi[-((Sqrt[a]*d)/Sqrt[b]) + I*d*x] - ExpIntegralEi[(Sqrt[a]
*d)/Sqrt[b] + I*d*x]))/Sqrt[b] + (8*I)*E^(I*c - (Sqrt[a]*d)/Sqrt[b])*(E^((
2*Sqrt[a]*d)/Sqrt[b])*ExpIntegralEi[-((Sqrt[a]*d)/Sqrt[b]) + I*d*x] + ExpI
ntegralEi[(Sqrt[a]*d)/Sqrt[b] + I*d*x]) + (I*Sqrt[a]*d*E^(I*c - (Sqrt[a]*d
)/Sqrt[b])*(-((Sqrt[b] - Sqrt[a]*d)*E^((2*Sqrt[a]*d)/Sqrt[b])*ExpIntegralE
i[-((Sqrt[a]*d)/Sqrt[b]) + I*d*x]) + (Sqrt[b] + Sqrt[a]*d)*ExpIntegralEi[(
Sqrt[a]*d)/Sqrt[b] + I*d*x]))/b + 32*CosIntegral[d*x]*Sin[c] + (8*a*(3*a +
 2*b*x^2)*Sin[c + d*x])/(a + b*x^2)^2 + 32*Cos[c]*SinIntegral[d*x])/(32*a^
3)
```

### 3.76.3 Rubi [A] (verified)

Time = 1.92 (sec) , antiderivative size = 730, normalized size of antiderivative = 1.00, number of steps used = 2, number of rules used = 2, $\frac{\text{number of rules}}{\text{integrand size}} = 0.105$, Rules used = {3826, 2009}

Below are the steps used by Rubi to obtain the solution. The rule number used for the transformation is given above next to the arrow. The rules definitions used are listed below.

$$\int \frac{\sin(c+dx)}{x(a+bx^2)^3}\,dx$$

$$\Big\downarrow \text{3826}$$

$$\int \left(-\frac{bx\sin(c+dx)}{a^3(a+bx^2)}+\frac{\sin(c+dx)}{a^3x}-\frac{bx\sin(c+dx)}{a^2(a+bx^2)^2}-\frac{bx\sin(c+dx)}{a(a+bx^2)^3}\right)dx$$

$$\Big\downarrow \text{2009}$$

$$-\frac{\sin\left(c-\frac{\sqrt{-a}d}{\sqrt{b}}\right)\text{CosIntegral}\left(xd+\frac{\sqrt{-a}d}{\sqrt{b}}\right)}{2a^3}-\frac{\sin\left(\frac{\sqrt{-a}d}{\sqrt{b}}+c\right)\text{CosIntegral}\left(\frac{\sqrt{-a}d}{\sqrt{b}}-dx\right)}{2a^3}+\frac{\cos\left(\frac{\sqrt{-a}d}{\sqrt{b}}+c\right)\text{Si}\left(\frac{\sqrt{-a}d}{\sqrt{b}}-dx\right)}{2a^3}-\frac{\cos\left(c-\frac{\sqrt{-a}d}{\sqrt{b}}\right)\text{Si}\left(xd+\frac{\sqrt{-a}d}{\sqrt{b}}\right)}{2a^3}+\frac{\sin(c)\,\text{CosIntegral}(dx)}{a^3}+\frac{\cos(c)\text{Si}(dx)}{a^3}-\frac{d^2\sin\left(c-\frac{\sqrt{-a}d}{\sqrt{b}}\right)\text{CosIntegral}\left(xd+\frac{\sqrt{-a}d}{\sqrt{b}}\right)}{16a^2b}-\frac{d^2\sin\left(\frac{\sqrt{-a}d}{\sqrt{b}}+c\right)\text{CosIntegral}\left(\frac{\sqrt{-a}d}{\sqrt{b}}-dx\right)}{16a^2b}+\frac{d^2\cos\left(\frac{\sqrt{-a}d}{\sqrt{b}}+c\right)\text{Si}\left(\frac{\sqrt{-a}d}{\sqrt{b}}-dx\right)}{16a^2b}-\frac{d^2\cos\left(c-\frac{\sqrt{-a}d}{\sqrt{b}}\right)\text{Si}\left(xd+\frac{\sqrt{-a}d}{\sqrt{b}}\right)}{16a^2b}+\frac{\sin(c+dx)}{2a^2(a+bx^2)}+\frac{d\cos(c+dx)}{16a^2\sqrt{b}\left(\sqrt{-a}-\sqrt{b}x\right)}-\frac{d\cos(c+dx)}{16a^2\sqrt{b}\left(\sqrt{-a}+\sqrt{b}x\right)}-\frac{5d\cos\left(\frac{\sqrt{-a}d}{\sqrt{b}}+c\right)\text{CosIntegral}\left(\frac{\sqrt{-a}d}{\sqrt{b}}-dx\right)}{16(-a)^{5/2}\sqrt{b}}+\frac{5d\cos\left(c-\frac{\sqrt{-a}d}{\sqrt{b}}\right)\text{CosIntegral}\left(xd+\frac{\sqrt{-a}d}{\sqrt{b}}\right)}{16(-a)^{5/2}\sqrt{b}}-\frac{5d\sin\left(\frac{\sqrt{-a}d}{\sqrt{b}}+c\right)\text{Si}\left(\frac{\sqrt{-a}d}{\sqrt{b}}-dx\right)}{16(-a)^{5/2}\sqrt{b}}-\frac{5d\sin\left(c-\frac{\sqrt{-a}d}{\sqrt{b}}\right)\text{Si}\left(xd+\frac{\sqrt{-a}d}{\sqrt{b}}\right)}{16(-a)^{5/2}\sqrt{b}}+\frac{\sin(c+dx)}{4a\left(a+bx^2\right)^2}$$

input
```
Int[Sin[c + d*x]/(x*(a + b*x^2)^3),x]
```

3.76. $\int \frac{\sin(c+dx)}{x(a+bx^2)^3}\,dx$

output
```
(d*Cos[c + d*x])/(16*a^2*Sqrt[b]*(Sqrt[-a] - Sqrt[b]*x)) - (d*Cos[c + d*x]
)/(16*a^2*Sqrt[b]*(Sqrt[-a] + Sqrt[b]*x)) - (5*d*Cos[c + (Sqrt[-a]*d)/Sqrt
[b]]*CosIntegral[(Sqrt[-a]*d)/Sqrt[b] - d*x])/(16*(-a)^(5/2)*Sqrt[b]) + (5
*d*Cos[c - (Sqrt[-a]*d)/Sqrt[b]]*CosIntegral[(Sqrt[-a]*d)/Sqrt[b] + d*x])/
(16*(-a)^(5/2)*Sqrt[b]) + (CosIntegral[d*x]*Sin[c])/a^3 - (CosIntegral[(Sq
rt[-a]*d)/Sqrt[b] + d*x]*Sin[c - (Sqrt[-a]*d)/Sqrt[b]])/(2*a^3) - (d^2*Cos
Integral[(Sqrt[-a]*d)/Sqrt[b] + d*x]*Sin[c - (Sqrt[-a]*d)/Sqrt[b]])/(16*a^
2*b) - (CosIntegral[(Sqrt[-a]*d)/Sqrt[b] - d*x]*Sin[c + (Sqrt[-a]*d)/Sqrt[
b]])/(2*a^3) - (d^2*CosIntegral[(Sqrt[-a]*d)/Sqrt[b] - d*x]*Sin[c + (Sqrt[
-a]*d)/Sqrt[b]])/(16*a^2*b) + Sin[c + d*x]/(4*a*(a + b*x^2)^2) + Sin[c + d
*x]/(2*a^2*(a + b*x^2)) + (Cos[c]*SinIntegral[d*x])/a^3 + (Cos[c + (Sqrt[-
a]*d)/Sqrt[b]]*SinIntegral[(Sqrt[-a]*d)/Sqrt[b] - d*x])/(2*a^3) + (d^2*Cos
[c + (Sqrt[-a]*d)/Sqrt[b]]*SinIntegral[(Sqrt[-a]*d)/Sqrt[b] - d*x])/(16*a^
2*b) - (5*d*Sin[c + (Sqrt[-a]*d)/Sqrt[b]]*SinIntegral[(Sqrt[-a]*d)/Sqrt[b]
 - d*x])/(16*(-a)^(5/2)*Sqrt[b]) - (Cos[c - (Sqrt[-a]*d)/Sqrt[b]]*SinInteg
ral[(Sqrt[-a]*d)/Sqrt[b] + d*x])/(2*a^3) - (d^2*Cos[c - (Sqrt[-a]*d)/Sqrt[
b]]*SinIntegral[(Sqrt[-a]*d)/Sqrt[b] + d*x])/(16*a^2*b) - (5*d*Sin[c - (Sq
rt[-a]*d)/Sqrt[b]]*SinIntegral[(Sqrt[-a]*d)/Sqrt[b] + d*x])/(16*(-a)^(5/2)
*Sqrt[b])
```

#### 3.76.3.1 Defintions of rubi rules used

rule 2009
```
Int[u_, x_Symbol] :> Simp[IntSum[u, x], x] /; SumQ[u]
```

rule 3826
```
Int[(x_)^(m_.)*((a_) + (b_.)*(x_)^(n_))^(p_)*Sin[(c_.) + (d_.)*(x_)], x_Sym
bol] :> Int[ExpandIntegrand[Sin[c + d*x], x^m*(a + b*x^n)^p, x], x] /; Free
Q[{a, b, c, d, m}, x] && ILtQ[p, 0] && IGtQ[n, 0] && (EqQ[n, 2] || EqQ[p, -
1]) && IntegerQ[m]
```

### 3.76. $\int \frac{\sin(c+dx)}{x(a+bx^2)^3}\,dx$

### 3.76.4 Maple [A] (verified)

Time = 0.56 (sec) , antiderivative size = 580, normalized size of antiderivative = 0.79

| method | result |
|---|---|
| derivativedivides | $\frac{\sin(dx+c)d^2\left(3a\,d^2+2c^2b-4bc(dx+c)+2b(dx+c)^2\right)}{4a^2\left(a\,d^2+c^2b-2bc(dx+c)+b(dx+c)^2\right)^2}-\frac{\cos(dx+c)d^3x}{8a^2\left(a\,d^2+c^2b-2bc(dx+c)+b(dx+c)^2\right)}+\frac{\mathrm{Si}(dx)\cos(c)+\mathrm{Ci}(d}{a^3}$ |
| default | $\frac{\sin(dx+c)d^2\left(3a\,d^2+2c^2b-4bc(dx+c)+2b(dx+c)^2\right)}{4a^2\left(a\,d^2+c^2b-2bc(dx+c)+b(dx+c)^2\right)^2}-\frac{\cos(dx+c)d^3x}{8a^2\left(a\,d^2+c^2b-2bc(dx+c)+b(dx+c)^2\right)}+\frac{\mathrm{Si}(dx)\cos(c)+\mathrm{Ci}(d}{a^3}$ |
| risch | $\frac{ie^{-\frac{icb-d\sqrt{ab}}{b}}\mathrm{Ei}_1\left(-\frac{icb-d\sqrt{ab}-b(idx+ic)}{b}\right)}{4a^3}+\frac{ie^{-\frac{icb+d\sqrt{ab}}{b}}\mathrm{Ei}_1\left(-\frac{icb+d\sqrt{ab}-b(idx+ic)}{b}\right)}{4a^3}-\frac{ie^{\frac{icb+d\sqrt{ab}}{b}}\mathrm{Ei}_1\left(\frac{icb+d\sqrt{ab}}{}\right.}{32b\,a^2}$ |

input
```
int(sin(d*x+c)/x/(b*x^2+a)^3,x,method=_RETURNVERBOSE)
```

output
```
1/4*sin(d*x+c)*d^2*(3*a*d^2+2*c^2*b-4*b*c*(d*x+c)+2*b*(d*x+c)^2)/a^2/(a*d^
2+c^2*b-2*b*c*(d*x+c)+b*(d*x+c)^2)^2-1/8*cos(d*x+c)*d^3*x/a^2/(a*d^2+c^2*b
-2*b*c*(d*x+c)+b*(d*x+c)^2)+1/a^3*(Si(d*x)*cos(c)+Ci(d*x)*sin(c))-1/16*(a*
d^2+8*b)/b/a^3*(Si(d*x+c-(d*(-a*b)^(1/2)+c*b)/b)*cos((d*(-a*b)^(1/2)+c*b)/
b)+Ci(d*x+c-(d*(-a*b)^(1/2)+c*b)/b)*sin((d*(-a*b)^(1/2)+c*b)/b))-1/16*(a*d
^2+8*b)/b/a^3*(Si(d*x+c+(d*(-a*b)^(1/2)-c*b)/b)*cos((d*(-a*b)^(1/2)-c*b)/b
)-Ci(d*x+c+(d*(-a*b)^(1/2)-c*b)/b)*sin((d*(-a*b)^(1/2)-c*b)/b))+5/16*d^2/a
^2/b/(-(d*(-a*b)^(1/2)+c*b)/b+c)*(-Si(d*x+c-(d*(-a*b)^(1/2)+c*b)/b)*sin((d
*(-a*b)^(1/2)+c*b)/b)+Ci(d*x+c-(d*(-a*b)^(1/2)+c*b)/b)*cos((d*(-a*b)^(1/2)
+c*b)/b))+5/16*d^2/a^2/b/((d*(-a*b)^(1/2)-c*b)/b+c)*(Si(d*x+c+(d*(-a*b)^(1
/2)-c*b)/b)*sin((d*(-a*b)^(1/2)-c*b)/b)+Ci(d*x+c+(d*(-a*b)^(1/2)-c*b)/b)*c
os((d*(-a*b)^(1/2)-c*b)/b))
```

### 3.76.5 Fricas [C] (verification not implemented)

Result contains complex when optimal does not.

Time = 0.36 (sec) , antiderivative size = 637, normalized size of antiderivative = 0.87

$$\int \frac{\sin(c+dx)}{x\left(a+bx^2\right)^3}\,dx =$$

$$-\frac{\left(-i\,a^3d^2-i\,(ab^2d^2+8\,b^3)x^4-8i\,a^2b-2i\,(a^2bd^2+8\,ab^2)x^2+5\,(i\,b^3x^4+2i\,ab^2x^2+i\,a^2b)\sqrt{\frac{ad^2}{b}}\right)\mathrm{Ei}\left(i\right.}{}$$

input
```
integrate(sin(d*x+c)/x/(b*x^2+a)^3,x, algorithm="fricas")
```

output
```
-1/32*((-I*a^3*d^2 - I*(a*b^2*d^2 + 8*b^3)*x^4 - 8*I*a^2*b - 2*I*(a^2*b*d^
2 + 8*a*b^2)*x^2 + 5*(I*b^3*x^4 + 2*I*a*b^2*x^2 + I*a^2*b)*sqrt(a*d^2/b))*
Ei(I*d*x - sqrt(a*d^2/b))*e^(I*c + sqrt(a*d^2/b)) + (-I*a^3*d^2 - I*(a*b^2
*d^2 + 8*b^3)*x^4 - 8*I*a^2*b - 2*I*(a^2*b*d^2 + 8*a*b^2)*x^2 + 5*(-I*b^3*
x^4 - 2*I*a*b^2*x^2 - I*a^2*b)*sqrt(a*d^2/b))*Ei(I*d*x + sqrt(a*d^2/b))*e^
(I*c - sqrt(a*d^2/b)) + (I*a^3*d^2 + I*(a*b^2*d^2 + 8*b^3)*x^4 + 8*I*a^2*b
 + 2*I*(a^2*b*d^2 + 8*a*b^2)*x^2 + 5*(-I*b^3*x^4 - 2*I*a*b^2*x^2 - I*a^2*b
)*sqrt(a*d^2/b))*Ei(-I*d*x - sqrt(a*d^2/b))*e^(-I*c + sqrt(a*d^2/b)) + (I*
a^3*d^2 + I*(a*b^2*d^2 + 8*b^3)*x^4 + 8*I*a^2*b + 2*I*(a^2*b*d^2 + 8*a*b^2
)*x^2 + 5*(I*b^3*x^4 + 2*I*a*b^2*x^2 + I*a^2*b)*sqrt(a*d^2/b))*Ei(-I*d*x +
 sqrt(a*d^2/b))*e^(-I*c - sqrt(a*d^2/b)) - 32*(b^3*x^4 + 2*a*b^2*x^2 + a^2
*b)*cos_integral(d*x)*sin(c) - 32*(b^3*x^4 + 2*a*b^2*x^2 + a^2*b)*cos(c)*s
in_integral(d*x) + 4*(a*b^2*d*x^3 + a^2*b*d*x)*cos(d*x + c) - 8*(2*a*b^2*x
^2 + 3*a^2*b)*sin(d*x + c))/(a^3*b^3*x^4 + 2*a^4*b^2*x^2 + a^5*b)
```

### 3.76.6 Sympy [F]

$$\int \frac{\sin(c+dx)}{x(a+bx^2)^3}\,dx = \int \frac{\sin(c+dx)}{x(a+bx^2)^3}\,dx$$

input
```
integrate(sin(d*x+c)/x/(b*x**2+a)**3,x)
```

output
```
Integral(sin(c + d*x)/(x*(a + b*x**2)**3), x)
```

### 3.76.7 Maxima [F]

$$\int \frac{\sin(c+dx)}{x(a+bx^2)^3}\,dx = \int \frac{\sin(dx+c)}{(bx^2+a)^3 x}\,dx$$

input
```
integrate(sin(d*x+c)/x/(b*x^2+a)^3,x, algorithm="maxima")
```

output
```
integrate(sin(d*x + c)/((b*x^2 + a)^3*x), x)
```

### 3.76.8 Giac [F]

$$\int \frac{\sin(c+dx)}{x\left(a+bx^2\right)^3}\,dx=\int \frac{\sin\left(dx+c\right)}{\left(bx^2+a\right)^3x}\,dx$$

input
```
integrate(sin(d*x+c)/x/(b*x^2+a)^3,x, algorithm="giac")
```

output
```
integrate(sin(d*x + c)/((b*x^2 + a)^3*x), x)
```

### 3.76.9 Mupad [F(-1)]

Timed out.

$$\int \frac{\sin(c+dx)}{x\left(a+bx^2\right)^3}\,dx=\int \frac{\sin\left(c+d\,x\right)}{x\left(b\,x^2+a\right)^3}\,dx$$

input
```
int(sin(c + d*x)/(x*(a + b*x^2)^3),x)
```

output
```
int(sin(c + d*x)/(x*(a + b*x^2)^3), x)
```

# 3.77 $\int \frac{\sin(c+dx)}{x^2(a+bx^2)^3}\,dx$

## 3.77.1 Optimal result

Integrand size = 19, antiderivative size = 875

$$\int \frac{\sin(c+dx)}{x^2(a+bx^2)^3}\,dx = \frac{d\cos(c+dx)}{16(-a)^{5/2}\left(\sqrt{-a}-\sqrt{b}x\right)} + \frac{d\cos(c+dx)}{16(-a)^{5/2}\left(\sqrt{-a}+\sqrt{b}x\right)}$$
$$+ \frac{d\cos(c)\,\text{CosIntegral}(dx)}{a^3}$$
$$+ \frac{7d\cos\left(c+\frac{\sqrt{-a}d}{\sqrt{b}}\right)\text{CosIntegral}\left(\frac{\sqrt{-a}d}{\sqrt{b}}-dx\right)}{16a^3}$$
$$+ \frac{7d\cos\left(c-\frac{\sqrt{-a}d}{\sqrt{b}}\right)\text{CosIntegral}\left(\frac{\sqrt{-a}d}{\sqrt{b}}+dx\right)}{16a^3}$$
$$- \frac{15\sqrt{b}\,\text{CosIntegral}\left(\frac{\sqrt{-a}d}{\sqrt{b}}+dx\right)\sin\left(c-\frac{\sqrt{-a}d}{\sqrt{b}}\right)}{16(-a)^{7/2}}$$
$$+ \frac{d^2\,\text{CosIntegral}\left(\frac{\sqrt{-a}d}{\sqrt{b}}+dx\right)\sin\left(c-\frac{\sqrt{-a}d}{\sqrt{b}}\right)}{16(-a)^{5/2}\sqrt{b}}$$
$$+ \frac{15\sqrt{b}\,\text{CosIntegral}\left(\frac{\sqrt{-a}d}{\sqrt{b}}-dx\right)\sin\left(c+\frac{\sqrt{-a}d}{\sqrt{b}}\right)}{16(-a)^{7/2}}$$
$$- \frac{d^2\,\text{CosIntegral}\left(\frac{\sqrt{-a}d}{\sqrt{b}}-dx\right)\sin\left(c+\frac{\sqrt{-a}d}{\sqrt{b}}\right)}{16(-a)^{5/2}\sqrt{b}} - \frac{\sin(c+dx)}{a^3x}$$
$$- \frac{\sqrt{b}\sin(c+dx)}{16(-a)^{5/2}\left(\sqrt{-a}-\sqrt{b}x\right)^2} + \frac{7\sqrt{b}\sin(c+dx)}{16a^3\left(\sqrt{-a}-\sqrt{b}x\right)}$$
$$+ \frac{\sqrt{b}\sin(c+dx)}{16(-a)^{5/2}\left(\sqrt{-a}+\sqrt{b}x\right)^2} - \frac{7\sqrt{b}\sin(c+dx)}{16a^3\left(\sqrt{-a}+\sqrt{b}x\right)}$$
$$- \frac{d\sin(c)\text{Si}(dx)}{a^3} - \frac{15\sqrt{b}\cos\left(c+\frac{\sqrt{-a}d}{\sqrt{b}}\right)\text{Si}\left(\frac{\sqrt{-a}d}{\sqrt{b}}-dx\right)}{16(-a)^{7/2}}$$
$$+ \frac{d^2\cos\left(c+\frac{\sqrt{-a}d}{\sqrt{b}}\right)\text{Si}\left(\frac{\sqrt{-a}d}{\sqrt{b}}-dx\right)}{16(-a)^{5/2}\sqrt{b}}$$
$$+ \frac{7d\sin\left(c+\frac{\sqrt{-a}d}{\sqrt{b}}\right)\text{Si}\left(\frac{\sqrt{-a}d}{\sqrt{b}}-dx\right)}{16a^3}$$
$$- \frac{15\sqrt{b}\cos\left(c-\frac{\sqrt{-a}d}{\sqrt{b}}\right)\text{Si}\left(\frac{\sqrt{-a}d}{\sqrt{b}}+dx\right)}{16(-a)^{7/2}}$$
$$+ \frac{d^2\cos\left(c-\frac{\sqrt{-a}d}{\sqrt{b}}\right)\text{Si}\left(\frac{\sqrt{-a}d}{\sqrt{b}}+dx\right)}{16(-a)^{5/2}\sqrt{b}}$$
$$- \frac{7d\sin\left(c-\frac{\sqrt{-a}d}{\sqrt{b}}\right)\text{Si}\left(\frac{\sqrt{-a}d}{\sqrt{b}}+dx\right)}{16a^3}$$

output
```
d*Ci(d*x)*cos(c)/a^3+7/16*d*Ci(d*x+d*(-a)^(1/2)/b^(1/2))*cos(c-d*(-a)^(1/2
)/b^(1/2))/a^3+7/16*d*Ci(-d*x+d*(-a)^(1/2)/b^(1/2))*cos(c+d*(-a)^(1/2)/b^(
1/2))/a^3-d*Si(d*x)*sin(c)/a^3-sin(d*x+c)/a^3/x-7/16*d*Si(d*x+d*(-a)^(1/2)
/b^(1/2))*sin(c-d*(-a)^(1/2)/b^(1/2))/a^3-7/16*d*Si(d*x-d*(-a)^(1/2)/b^(1/
2))*sin(c+d*(-a)^(1/2)/b^(1/2))/a^3-1/16*d^2*cos(c+d*(-a)^(1/2)/b^(1/2))*S
i(d*x-d*(-a)^(1/2)/b^(1/2))/(-a)^(5/2)/b^(1/2)+1/16*d^2*cos(c-d*(-a)^(1/2)
/b^(1/2))*Si(d*x+d*(-a)^(1/2)/b^(1/2))/(-a)^(5/2)/b^(1/2)+1/16*d^2*Ci(d*x+
d*(-a)^(1/2)/b^(1/2))*sin(c-d*(-a)^(1/2)/b^(1/2))/(-a)^(5/2)/b^(1/2)-1/16*
d^2*Ci(-d*x+d*(-a)^(1/2)/b^(1/2))*sin(c+d*(-a)^(1/2)/b^(1/2))/(-a)^(5/2)/b
^(1/2)+15/16*cos(c+d*(-a)^(1/2)/b^(1/2))*Si(d*x-d*(-a)^(1/2)/b^(1/2))*b^(1
/2)/(-a)^(7/2)-15/16*cos(c-d*(-a)^(1/2)/b^(1/2))*Si(d*x+d*(-a)^(1/2)/b^(1/
2))*b^(1/2)/(-a)^(7/2)-15/16*Ci(d*x+d*(-a)^(1/2)/b^(1/2))*sin(c-d*(-a)^(1/
2)/b^(1/2))*b^(1/2)/(-a)^(7/2)+15/16*Ci(-d*x+d*(-a)^(1/2)/b^(1/2))*sin(c+d
*(-a)^(1/2)/b^(1/2))*b^(1/2)/(-a)^(7/2)-1/16*sin(d*x+c)*b^(1/2)/(-a)^(5/2)
/((-a)^(1/2)-x*b^(1/2))^2+1/16*d*cos(d*x+c)/(-a)^(5/2)/((-a)^(1/2)-x*b^(1/
2))+7/16*sin(d*x+c)*b^(1/2)/a^3/((-a)^(1/2)-x*b^(1/2))+1/16*sin(d*x+c)*b^(
1/2)/(-a)^(5/2)/((-a)^(1/2)+x*b^(1/2))^2+1/16*d*cos(d*x+c)/(-a)^(5/2)/((-a
)^(1/2)+x*b^(1/2))-7/16*sin(d*x+c)*b^(1/2)/a^3/((-a)^(1/2)+x*b^(1/2))
```

### 3.77.2 Mathematica [C] (verified)

Result contains complex when optimal does not.

Time = 4.04 (sec) , antiderivative size = 593, normalized size of antiderivative = 0.68

$$\int \frac{\sin(c+dx)}{x^2\left(a+bx^2\right)^3}\,dx$$

$$= \frac{8\sqrt{b}e^{-ic-\frac{\sqrt{a}d}{\sqrt{b}}}\left(-e^{\frac{2\sqrt{a}d}{\sqrt{b}}}\text{ExpIntegralEi}\left(-\frac{\sqrt{a}d}{\sqrt{b}}-idx\right)+\text{ExpIntegralEi}\left(\frac{\sqrt{a}d}{\sqrt{b}}-idx\right)\right)+\frac{e^{-ic-\frac{\sqrt{a}d}{\sqrt{b}}}\left(-\left(\left(7b-7\sqrt{a}\cdots\right.\right.\right.}{}}{}$$

input
```
Integrate[Sin[c + d*x]/(x^2*(a + b*x^2)^3),x]
```

output
```
(8*Sqrt[b]*E^((-I)*c - (Sqrt[a]*d)/Sqrt[b])*(-(E^((2*Sqrt[a]*d)/Sqrt[b])*E
xpIntegralEi[-((Sqrt[a]*d)/Sqrt[b]) - I*d*x]) + ExpIntegralEi[(Sqrt[a]*d)/
Sqrt[b] - I*d*x]) + (E^((-I)*c - (Sqrt[a]*d)/Sqrt[b])*(-((7*b - 7*Sqrt[a]*
Sqrt[b]*d + a*d^2)*E^((2*Sqrt[a]*d)/Sqrt[b])*ExpIntegralEi[-((Sqrt[a]*d)/S
qrt[b]) - I*d*x]) + (7*b + 7*Sqrt[a]*Sqrt[b]*d + a*d^2)*ExpIntegralEi[(Sqr
t[a]*d)/Sqrt[b] - I*d*x]))/Sqrt[b] + 8*Sqrt[b]*E^(I*c - (Sqrt[a]*d)/Sqrt[b
])*(-(E^((2*Sqrt[a]*d)/Sqrt[b])*ExpIntegralEi[-((Sqrt[a]*d)/Sqrt[b]) + I*d
*x]) + ExpIntegralEi[(Sqrt[a]*d)/Sqrt[b] + I*d*x]) + (E^(I*c - (Sqrt[a]*d)
/Sqrt[b])*(-((7*b - 7*Sqrt[a]*Sqrt[b]*d + a*d^2)*E^((2*Sqrt[a]*d)/Sqrt[b])
*ExpIntegralEi[-((Sqrt[a]*d)/Sqrt[b]) + I*d*x]) + (7*b + 7*Sqrt[a]*Sqrt[b]
*d + a*d^2)*ExpIntegralEi[(Sqrt[a]*d)/Sqrt[b] + I*d*x]))/Sqrt[b] - (4*Sqrt
[a]*Cos[d*x]*(a*d*x*(a + b*x^2)*Cos[c] + (8*a^2 + 25*a*b*x^2 + 15*b^2*x^4)
*Sin[c]))/(x*(a + b*x^2)^2) + (4*Sqrt[a]*(-((8*a^2 + 25*a*b*x^2 + 15*b^2*x
^4)*Cos[c]) + a*d*x*(a + b*x^2)*Sin[c])*Sin[d*x])/(x*(a + b*x^2)^2) + 32*S
qrt[a]*d*(Cos[c]*CosIntegral[d*x] - Sin[c]*SinIntegral[d*x]))/(32*a^(7/2))
```

### 3.77.3 Rubi [A] (verified)

Time = 2.75 (sec) , antiderivative size = 875, normalized size of antiderivative = 1.00, number of steps used = 2, number of rules used = 2, $\frac{\text{number of rules}}{\text{integrand size}} = 0.105$, Rules used = {3826, 2009}

Below are the steps used by Rubi to obtain the solution. The rule number used for the transformation is given above next to the arrow. The rules definitions used are listed below.

$$\int \frac{\sin(c+dx)}{x^2\left(a+bx^2\right)^3}\,dx$$

$$\Big\downarrow \text{3826}$$

$$\int \left(-\frac{b\sin(c+dx)}{a^3\left(a+bx^2\right)}+\frac{\sin(c+dx)}{a^3x^2}-\frac{b\sin(c+dx)}{a^2\left(a+bx^2\right)^2}-\frac{b\sin(c+dx)}{a\left(a+bx^2\right)^3}\right)dx$$

$$\Big\downarrow \text{2009}$$

$$\frac{\text{CosIntegral}\left(xd+\frac{\sqrt{-a}d}{\sqrt{b}}\right)\sin\left(c-\frac{\sqrt{-a}d}{\sqrt{b}}\right)d^2}{16(-a)^{5/2}\sqrt{b}}-\frac{\text{CosIntegral}\left(\frac{\sqrt{-a}d}{\sqrt{b}}-dx\right)\sin\left(c+\frac{\sqrt{-a}d}{\sqrt{b}}\right)d^2}{16(-a)^{5/2}\sqrt{b}}+\frac{\cos\left(c+\frac{\sqrt{-a}d}{\sqrt{b}}\right)\text{Si}\left(\frac{\sqrt{-a}d}{\sqrt{b}}-dx\right)d^2}{16(-a)^{5/2}\sqrt{b}}+\frac{\cos\left(c-\frac{\sqrt{-a}d}{\sqrt{b}}\right)\text{Si}\left(xd+\frac{\sqrt{-a}d}{\sqrt{b}}\right)d^2}{16(-a)^{5/2}\sqrt{b}}+\frac{\cos(c+dx)d}{16(-a)^{5/2}\left(\sqrt{-a}-\sqrt{b}x\right)}+\frac{\cos(c+dx)d}{16(-a)^{5/2}\left(\sqrt{b}x+\sqrt{-a}\right)}+\frac{\cos(c)\,\text{CosIntegral}(dx)d}{a^3}+\frac{7\cos\left(c+\frac{\sqrt{-a}d}{\sqrt{b}}\right)\text{CosIntegral}\left(\frac{\sqrt{-a}d}{\sqrt{b}}-dx\right)d}{16a^3}+\frac{7\cos\left(c-\frac{\sqrt{-a}d}{\sqrt{b}}\right)\text{CosIntegral}\left(xd+\frac{\sqrt{-a}d}{\sqrt{b}}\right)d}{16a^3}-\frac{\sin(c)\text{Si}(dx)d}{a^3}+\frac{7\sin\left(c+\frac{\sqrt{-a}d}{\sqrt{b}}\right)\text{Si}\left(\frac{\sqrt{-a}d}{\sqrt{b}}-dx\right)d}{16a^3}-\frac{7\sin\left(c-\frac{\sqrt{-a}d}{\sqrt{b}}\right)\text{Si}\left(xd+\frac{\sqrt{-a}d}{\sqrt{b}}\right)d}{16a^3}-\frac{15\sqrt{b}\,\text{CosIntegral}\left(xd+\frac{\sqrt{-a}d}{\sqrt{b}}\right)\sin\left(c-\frac{\sqrt{-a}d}{\sqrt{b}}\right)}{16(-a)^{7/2}}+\frac{15\sqrt{b}\,\text{CosIntegral}\left(\frac{\sqrt{-a}d}{\sqrt{b}}-dx\right)\sin\left(c+\frac{\sqrt{-a}d}{\sqrt{b}}\right)}{16(-a)^{7/2}}-\frac{\sin(c+dx)}{a^3x}+\frac{7\sqrt{b}\sin(c+dx)}{16a^3\left(\sqrt{-a}-\sqrt{b}x\right)}-\frac{7\sqrt{b}\sin(c+dx)}{16a^3\left(\sqrt{b}x+\sqrt{-a}\right)}-\frac{\sqrt{b}\sin(c+dx)}{16(-a)^{5/2}\left(\sqrt{-a}-\sqrt{b}x\right)^2}+\frac{\sqrt{b}\sin(c+dx)}{16(-a)^{5/2}\left(\sqrt{b}x+\sqrt{-a}\right)^2}-\frac{15\sqrt{b}\cos\left(c+\frac{\sqrt{-a}d}{\sqrt{b}}\right)\text{Si}\left(\frac{\sqrt{-a}d}{\sqrt{b}}-dx\right)}{16(-a)^{7/2}}-\frac{15\sqrt{b}\cos\left(c-\frac{\sqrt{-a}d}{\sqrt{b}}\right)\text{Si}\left(xd+\frac{\sqrt{-a}d}{\sqrt{b}}\right)}{16(-a)^{7/2}}$$

input
```
Int[Sin[c + d*x]/(x^2*(a + b*x^2)^3),x]
```

3.77. $\int \frac{\sin(c+dx)}{x^2(a+bx^2)^3}\,dx$

output
```
(d*Cos[c + d*x])/(16*(-a)^(5/2)*(Sqrt[-a] - Sqrt[b]*x)) + (d*Cos[c + d*x])
/(16*(-a)^(5/2)*(Sqrt[-a] + Sqrt[b]*x)) + (d*Cos[c]*CosIntegral[d*x])/a^3
+ (7*d*Cos[c + (Sqrt[-a]*d)/Sqrt[b]]*CosIntegral[(Sqrt[-a]*d)/Sqrt[b] - d*
x])/(16*a^3) + (7*d*Cos[c - (Sqrt[-a]*d)/Sqrt[b]]*CosIntegral[(Sqrt[-a]*d)
/Sqrt[b] + d*x])/(16*a^3) - (15*Sqrt[b]*CosIntegral[(Sqrt[-a]*d)/Sqrt[b] +
 d*x]*Sin[c - (Sqrt[-a]*d)/Sqrt[b]])/(16*(-a)^(7/2)) + (d^2*CosIntegral[(S
qrt[-a]*d)/Sqrt[b] + d*x]*Sin[c - (Sqrt[-a]*d)/Sqrt[b]])/(16*(-a)^(5/2)*Sq
rt[b]) + (15*Sqrt[b]*CosIntegral[(Sqrt[-a]*d)/Sqrt[b] - d*x]*Sin[c + (Sqrt
[-a]*d)/Sqrt[b]])/(16*(-a)^(7/2)) - (d^2*CosIntegral[(Sqrt[-a]*d)/Sqrt[b]
- d*x]*Sin[c + (Sqrt[-a]*d)/Sqrt[b]])/(16*(-a)^(5/2)*Sqrt[b]) - Sin[c + d*
x]/(a^3*x) - (Sqrt[b]*Sin[c + d*x])/(16*(-a)^(5/2)*(Sqrt[-a] - Sqrt[b]*x)^
2) + (7*Sqrt[b]*Sin[c + d*x])/(16*a^3*(Sqrt[-a] - Sqrt[b]*x)) + (Sqrt[b]*S
in[c + d*x])/(16*(-a)^(5/2)*(Sqrt[-a] + Sqrt[b]*x)^2) - (7*Sqrt[b]*Sin[c +
 d*x])/(16*a^3*(Sqrt[-a] + Sqrt[b]*x)) - (d*Sin[c]*SinIntegral[d*x])/a^3 -
 (15*Sqrt[b]*Cos[c + (Sqrt[-a]*d)/Sqrt[b]]*SinIntegral[(Sqrt[-a]*d)/Sqrt[b
] - d*x])/(16*(-a)^(7/2)) + (d^2*Cos[c + (Sqrt[-a]*d)/Sqrt[b]]*SinIntegral
[(Sqrt[-a]*d)/Sqrt[b] - d*x])/(16*(-a)^(5/2)*Sqrt[b]) + (7*d*Sin[c + (Sqrt
[-a]*d)/Sqrt[b]]*SinIntegral[(Sqrt[-a]*d)/Sqrt[b] - d*x])/(16*a^3) - (15*S
qrt[b]*Cos[c - (Sqrt[-a]*d)/Sqrt[b]]*SinIntegral[(Sqrt[-a]*d)/Sqrt[b] + d*
x])/(16*(-a)^(7/2)) + (d^2*Cos[c - (Sqrt[-a]*d)/Sqrt[b]]*SinIntegral[(S...
```

### 3.77.3.1 Defintions of rubi rules used

rule 2009
```
Int[u_, x_Symbol] :> Simp[IntSum[u, x], x] /; SumQ[u]
```

rule 3826
```
Int[(x_)^(m_.)*((a_) + (b_.)*(x_)^(n_))^(p_)*Sin[(c_.) + (d_.)*(x_)], x_Sym
bol] :> Int[ExpandIntegrand[Sin[c + d*x], x^m*(a + b*x^n)^p, x], x] /; Free
Q[{a, b, c, d, m}, x] && ILtQ[p, 0] && IGtQ[n, 0] && (EqQ[n, 2] || EqQ[p, -
1]) && IntegerQ[m]
```

### 3.77.4 Maple [C] (verified)

Result contains complex when optimal does not.

Time = 0.80 (sec) , antiderivative size = 910, normalized size of antiderivative = 1.04

| method | result |
|---|---|
| risch | $\frac{d^{2} \mathrm{e}^{\frac{icb+d\sqrt{ab}}{b}} \mathrm{Ei}_{1}\left(\frac{icb+d\sqrt{ab}-b(idx+ic)}{b}\right)}{32a^{2}\sqrt{ab}}-\frac{d^{2} \mathrm{e}^{\frac{icb-d\sqrt{ab}}{b}} \mathrm{Ei}_{1}\left(-\frac{-icb+d\sqrt{ab}+b(idx+ic)}{b}\right)}{32a^{2}\sqrt{ab}}-\frac{7d\, \mathrm{e}^{\frac{icb+d\sqrt{ab}}{b}} \mathrm{Ei}_{1}\left(\frac{icb+d\sqrt{a}}{}\right.}{32a^{3}}$ |
| derivativedivides | Expression too large to display |
| default | Expression too large to display |

input
```
int(sin(d*x+c)/x^2/(b*x^2+a)^3,x,method=_RETURNVERBOSE)
```

output
```
1/32/a^2*d^2/(a*b)^(1/2)*exp((I*c*b+d*(a*b)^(1/2))/b)*Ei(1,(I*c*b+d*(a*b)^
(1/2)-b*(I*d*x+I*c))/b)-1/32/a^2*d^2/(a*b)^(1/2)*exp((I*c*b-d*(a*b)^(1/2))
/b)*Ei(1,-(-I*c*b+d*(a*b)^(1/2)+b*(I*d*x+I*c))/b)-7/32*d/a^3*exp((I*c*b+d*
(a*b)^(1/2))/b)*Ei(1,(I*c*b+d*(a*b)^(1/2)-b*(I*d*x+I*c))/b)-7/32*d/a^3*exp
((I*c*b-d*(a*b)^(1/2))/b)*Ei(1,-(-I*c*b+d*(a*b)^(1/2)+b*(I*d*x+I*c))/b)+15
/32/a^3/(a*b)^(1/2)*exp((I*c*b+d*(a*b)^(1/2))/b)*Ei(1,(I*c*b+d*(a*b)^(1/2)
-b*(I*d*x+I*c))/b)*b-15/32/a^3/(a*b)^(1/2)*exp((I*c*b-d*(a*b)^(1/2))/b)*Ei
(1,-(-I*c*b+d*(a*b)^(1/2)+b*(I*d*x+I*c))/b)*b-1/2*d/a^3*Ei(1,-I*d*x)*exp(I
*c)-1/32/a^2*d^2/(a*b)^(1/2)*exp(-(I*c*b+d*(a*b)^(1/2))/b)*Ei(1,-(I*c*b+d*
(a*b)^(1/2)-b*(I*d*x+I*c))/b)+1/32/a^2*d^2/(a*b)^(1/2)*exp(-(I*c*b-d*(a*b)
^(1/2))/b)*Ei(1,(-I*c*b+d*(a*b)^(1/2)+b*(I*d*x+I*c))/b)-7/32*d/a^3*exp(-(I
*c*b+d*(a*b)^(1/2))/b)*Ei(1,-(I*c*b+d*(a*b)^(1/2)-b*(I*d*x+I*c))/b)-7/32*d
/a^3*exp(-(I*c*b-d*(a*b)^(1/2))/b)*Ei(1,(-I*c*b+d*(a*b)^(1/2)+b*(I*d*x+I*c
))/b)-15/32/a^3/(a*b)^(1/2)*exp(-(I*c*b+d*(a*b)^(1/2))/b)*Ei(1,-(I*c*b+d*(
a*b)^(1/2)-b*(I*d*x+I*c))/b)*b+15/32/a^3/(a*b)^(1/2)*exp(-(I*c*b-d*(a*b)^(
1/2))/b)*Ei(1,(-I*c*b+d*(a*b)^(1/2)+b*(I*d*x+I*c))/b)*b-1/2*d/a^3*Ei(1,I*d
*x)*exp(-I*c)+1/8/a^2*d^2*(b*d^3*x^3+a*d^3*x)/x/(-b^2*d^4*x^4-2*a*b*d^4*x^
2-a^2*d^4)*cos(d*x+c)-1/8*(-15*b^2*d^4*x^4-25*a*b*d^4*x^2-8*a^2*d^4)/a^3/x
/(-b^2*d^4*x^4-2*a*b*d^4*x^2-a^2*d^4)*sin(d*x+c)
```

### 3.77.5 Fricas [C] (verification not implemented)

Result contains complex when optimal does not.

Time = 0.30 (sec) , antiderivative size = 714, normalized size of antiderivative = 0.82

$$\int \frac{\sin(c+dx)}{x^2 (a+bx^2)^3} dx$$

$$= \frac{32 (ab^2d^2x^5 + 2a^2bd^2x^3 + a^3d^2x) \cos(c) \operatorname{Ci}(dx) + \left(7ab^2d^2x^5 + 14a^2bd^2x^3 + 7a^3d^2x - ((ab^2d^2 + 15b^3)x\right.}{}$$

input
```
integrate(sin(d*x+c)/x^2/(b*x^2+a)^3,x, algorithm="fricas")
```

output
```
1/32*(32*(a*b^2*d^2*x^5 + 2*a^2*b*d^2*x^3 + a^3*d^2*x)*cos(c)*cos_integral
(d*x) + (7*a*b^2*d^2*x^5 + 14*a^2*b*d^2*x^3 + 7*a^3*d^2*x - ((a*b^2*d^2 +
15*b^3)*x^5 + 2*(a^2*b*d^2 + 15*a*b^2)*x^3 + (a^3*d^2 + 15*a^2*b)*x)*sqrt(
a*d^2/b))*Ei(I*d*x - sqrt(a*d^2/b))*e^(I*c + sqrt(a*d^2/b)) + (7*a*b^2*d^2
*x^5 + 14*a^2*b*d^2*x^3 + 7*a^3*d^2*x + ((a*b^2*d^2 + 15*b^3)*x^5 + 2*(a^2
*b*d^2 + 15*a*b^2)*x^3 + (a^3*d^2 + 15*a^2*b)*x)*sqrt(a*d^2/b))*Ei(I*d*x +
 sqrt(a*d^2/b))*e^(I*c - sqrt(a*d^2/b)) + (7*a*b^2*d^2*x^5 + 14*a^2*b*d^2*
x^3 + 7*a^3*d^2*x - ((a*b^2*d^2 + 15*b^3)*x^5 + 2*(a^2*b*d^2 + 15*a*b^2)*x
^3 + (a^3*d^2 + 15*a^2*b)*x)*sqrt(a*d^2/b))*Ei(-I*d*x - sqrt(a*d^2/b))*e^(
-I*c + sqrt(a*d^2/b)) + (7*a*b^2*d^2*x^5 + 14*a^2*b*d^2*x^3 + 7*a^3*d^2*x
+ ((a*b^2*d^2 + 15*b^3)*x^5 + 2*(a^2*b*d^2 + 15*a*b^2)*x^3 + (a^3*d^2 + 15
*a^2*b)*x)*sqrt(a*d^2/b))*Ei(-I*d*x + sqrt(a*d^2/b))*e^(-I*c - sqrt(a*d^2/
b)) - 32*(a*b^2*d^2*x^5 + 2*a^2*b*d^2*x^3 + a^3*d^2*x)*sin(c)*sin_integral
(d*x) - 4*(a^2*b*d^2*x^3 + a^3*d^2*x)*cos(d*x + c) - 4*(15*a*b^2*d*x^4 + 2
5*a^2*b*d*x^2 + 8*a^3*d)*sin(d*x + c))/(a^4*b^2*d*x^5 + 2*a^5*b*d*x^3 + a^
6*d*x)
```

### 3.77.6 Sympy [F(-1)]

Timed out.

$$\int \frac{\sin(c+dx)}{x^2 (a+bx^2)^3} dx = \text{Timed out}$$

input
```
integrate(sin(d*x+c)/x**2/(b*x**2+a)**3,x)
```

output
```
Timed out
```

### 3.77.7 Maxima [F]

$$\int \frac{\sin(c+dx)}{x^2(a+bx^2)^3}\,dx = \int \frac{\sin(dx+c)}{(bx^2+a)^3x^2}\,dx$$

input
```
integrate(sin(d*x+c)/x^2/(b*x^2+a)^3,x, algorithm="maxima")
```

output
```
integrate(sin(d*x + c)/((b*x^2 + a)^3*x^2), x)
```

### 3.77.8 Giac [F]

$$\int \frac{\sin(c+dx)}{x^2(a+bx^2)^3}\,dx = \int \frac{\sin(dx+c)}{(bx^2+a)^3x^2}\,dx$$

input
```
integrate(sin(d*x+c)/x^2/(b*x^2+a)^3,x, algorithm="giac")
```

output
```
integrate(sin(d*x + c)/((b*x^2 + a)^3*x^2), x)
```

### 3.77.9 Mupad [F(-1)]

Timed out.

$$\int \frac{\sin(c+dx)}{x^2(a+bx^2)^3}\,dx = \int \frac{\sin(c+d\,x)}{x^2\,(b\,x^2+a)^3}\,dx$$

input
```
int(sin(c + d*x)/(x^2*(a + b*x^2)^3),x)
```

output
```
int(sin(c + d*x)/(x^2*(a + b*x^2)^3), x)
```

# 3.78 $\int \frac{\sin(c+dx)}{x^3(a+bx^2)^3}\,dx$

### 3.78.1 Optimal result

Integrand size = 19, antiderivative size = 791

$$\int \frac{\sin(c+dx)}{x^3(a+bx^2)^3}\,dx = -\frac{d\cos(c+dx)}{2a^3x} - \frac{\sqrt{b}d\cos(c+dx)}{16a^3\left(\sqrt{-a}-\sqrt{b}x\right)} + \frac{\sqrt{b}d\cos(c+dx)}{16a^3\left(\sqrt{-a}+\sqrt{b}x\right)} - \frac{9\sqrt{b}d\cos\left(c+\frac{\sqrt{-a}d}{\sqrt{b}}\right)\text{CosIntegral}\left(\frac{\sqrt{-a}d}{\sqrt{b}}-dx\right)}{16(-a)^{7/2}} + \frac{9\sqrt{b}d\cos\left(c-\frac{\sqrt{-a}d}{\sqrt{b}}\right)\text{CosIntegral}\left(\frac{\sqrt{-a}d}{\sqrt{b}}+dx\right)}{16(-a)^{7/2}} - \frac{3b\,\text{CosIntegral}(dx)\sin(c)}{a^4} - \frac{d^2\,\text{CosIntegral}(dx)\sin(c)}{2a^3} + \frac{3b\,\text{CosIntegral}\left(\frac{\sqrt{-a}d}{\sqrt{b}}+dx\right)\sin\left(c-\frac{\sqrt{-a}d}{\sqrt{b}}\right)}{2a^4} + \frac{d^2\,\text{CosIntegral}\left(\frac{\sqrt{-a}d}{\sqrt{b}}+dx\right)\sin\left(c-\frac{\sqrt{-a}d}{\sqrt{b}}\right)}{16a^3} + \frac{3b\,\text{CosIntegral}\left(\frac{\sqrt{-a}d}{\sqrt{b}}-dx\right)\sin\left(c+\frac{\sqrt{-a}d}{\sqrt{b}}\right)}{2a^4} + \frac{d^2\,\text{CosIntegral}\left(\frac{\sqrt{-a}d}{\sqrt{b}}-dx\right)\sin\left(c+\frac{\sqrt{-a}d}{\sqrt{b}}\right)}{16a^3} - \frac{\sin(c+dx)}{2a^3x^2} - \frac{b\sin(c+dx)}{4a^2(a+bx^2)^2} - \frac{b\sin(c+dx)}{a^3(a+bx^2)} - \frac{3b\cos(c)\text{Si}(dx)}{a^4} - \frac{d^2\cos(c)\text{Si}(dx)}{2a^3} - \frac{3b\cos\left(c+\frac{\sqrt{-a}d}{\sqrt{b}}\right)\text{Si}\left(\frac{\sqrt{-a}d}{\sqrt{b}}-dx\right)}{2a^4} - \frac{d^2\cos\left(c+\frac{\sqrt{-a}d}{\sqrt{b}}\right)\text{Si}\left(\frac{\sqrt{-a}d}{\sqrt{b}}-dx\right)}{16a^3} - \frac{9\sqrt{b}d\sin\left(c+\frac{\sqrt{-a}d}{\sqrt{b}}\right)\text{Si}\left(\frac{\sqrt{-a}d}{\sqrt{b}}-dx\right)}{16(-a)^{7/2}} + \frac{3b\cos\left(c-\frac{\sqrt{-a}d}{\sqrt{b}}\right)\text{Si}\left(\frac{\sqrt{-a}d}{\sqrt{b}}+dx\right)}{2a^4} + \frac{d^2\cos\left(c-\frac{\sqrt{-a}d}{\sqrt{b}}\right)\text{Si}\left(\frac{\sqrt{-a}d}{\sqrt{b}}+dx\right)}{16a^3} - \frac{9\sqrt{b}d\sin\left(c-\frac{\sqrt{-a}d}{\sqrt{b}}\right)\text{Si}\left(\frac{\sqrt{-a}d}{\sqrt{b}}+dx\right)}{16(-a)^{7/2}}$$

output
```
-1/2*d*cos(d*x+c)/a^3/x-3*b*cos(c)*Si(d*x)/a^4-1/2*d^2*cos(c)*Si(d*x)/a^3+
3/2*b*cos(c+d*(-a)^(1/2)/b^(1/2))*Si(d*x-d*(-a)^(1/2)/b^(1/2))/a^4+1/16*d^
2*cos(c+d*(-a)^(1/2)/b^(1/2))*Si(d*x-d*(-a)^(1/2)/b^(1/2))/a^3+3/2*b*cos(c
-d*(-a)^(1/2)/b^(1/2))*Si(d*x+d*(-a)^(1/2)/b^(1/2))/a^4+1/16*d^2*cos(c-d*(
-a)^(1/2)/b^(1/2))*Si(d*x+d*(-a)^(1/2)/b^(1/2))/a^3-3*b*Ci(d*x)*sin(c)/a^4
-1/2*d^2*Ci(d*x)*sin(c)/a^3-1/2*sin(d*x+c)/a^3/x^2-1/4*b*sin(d*x+c)/a^2/(b
*x^2+a)^2-b*sin(d*x+c)/a^3/(b*x^2+a)+3/2*b*Ci(d*x+d*(-a)^(1/2)/b^(1/2))*si
n(c-d*(-a)^(1/2)/b^(1/2))/a^4+1/16*d^2*Ci(d*x+d*(-a)^(1/2)/b^(1/2))*sin(c-
d*(-a)^(1/2)/b^(1/2))/a^3+3/2*b*Ci(-d*x+d*(-a)^(1/2)/b^(1/2))*sin(c+d*(-a)
^(1/2)/b^(1/2))/a^4+1/16*d^2*Ci(-d*x+d*(-a)^(1/2)/b^(1/2))*sin(c+d*(-a)^(1
/2)/b^(1/2))/a^3+9/16*d*Ci(d*x+d*(-a)^(1/2)/b^(1/2))*cos(c-d*(-a)^(1/2)/b^
(1/2))*b^(1/2)/(-a)^(7/2)-9/16*d*Ci(-d*x+d*(-a)^(1/2)/b^(1/2))*cos(c+d*(-a
)^(1/2)/b^(1/2))*b^(1/2)/(-a)^(7/2)-9/16*d*Si(d*x+d*(-a)^(1/2)/b^(1/2))*si
n(c-d*(-a)^(1/2)/b^(1/2))*b^(1/2)/(-a)^(7/2)+9/16*d*Si(d*x-d*(-a)^(1/2)/b^
(1/2))*sin(c+d*(-a)^(1/2)/b^(1/2))*b^(1/2)/(-a)^(7/2)-1/16*d*cos(d*x+c)*b^
(1/2)/a^3/((-a)^(1/2)-x*b^(1/2))+1/16*d*cos(d*x+c)*b^(1/2)/a^3/((-a)^(1/2)
+x*b^(1/2))
```

### 3.78.2 Mathematica [C] (verified)

Result contains complex when optimal does not.

Time = 1.86 (sec) , antiderivative size = 432, normalized size of antiderivative = 0.55

$$\int \frac{\sin(c+dx)}{x^3(a+bx^2)^3}\,dx$$
$$= \frac{ie^{-ic-\frac{\sqrt{a}d}{\sqrt{b}}}\left(\left(24b-9\sqrt{a}\sqrt{b}d+ad^2\right)e^{\frac{2\sqrt{a}d}{\sqrt{b}}}\text{ExpIntegralEi}\left(-\frac{\sqrt{a}d}{\sqrt{b}}-idx\right)+\left(24b+9\sqrt{a}\sqrt{b}d+ad^2\right)\text{ExpInt}}{}$$

input
```
Integrate[Sin[c + d*x]/(x^3*(a + b*x^2)^3),x]
```

output
```
(I*E^((-I)*c - (Sqrt[a]*d)/Sqrt[b])*((24*b - 9*Sqrt[a]*Sqrt[b]*d + a*d^2)*
E^((2*Sqrt[a]*d)/Sqrt[b])*ExpIntegralEi[-((Sqrt[a]*d)/Sqrt[b]) - I*d*x] +
(24*b + 9*Sqrt[a]*Sqrt[b]*d + a*d^2)*ExpIntegralEi[(Sqrt[a]*d)/Sqrt[b] - I
*d*x]) - I*E^(I*c - (Sqrt[a]*d)/Sqrt[b])*((24*b - 9*Sqrt[a]*Sqrt[b]*d + a*
d^2)*E^((2*Sqrt[a]*d)/Sqrt[b])*ExpIntegralEi[-((Sqrt[a]*d)/Sqrt[b]) + I*d*
x] + (24*b + 9*Sqrt[a]*Sqrt[b]*d + a*d^2)*ExpIntegralEi[(Sqrt[a]*d)/Sqrt[b
] + I*d*x]) - (4*a*Cos[d*x]*(d*x*(4*a^2 + 7*a*b*x^2 + 3*b^2*x^4)*Cos[c] +
2*(2*a^2 + 9*a*b*x^2 + 6*b^2*x^4)*Sin[c]))/(x^2*(a + b*x^2)^2) + (4*a*(-2*
(2*a^2 + 9*a*b*x^2 + 6*b^2*x^4)*Cos[c] + d*x*(4*a^2 + 7*a*b*x^2 + 3*b^2*x^
4)*Sin[c])*Sin[d*x])/(x^2*(a + b*x^2)^2) - 16*(6*b + a*d^2)*(CosIntegral[d
*x]*Sin[c] + Cos[c]*SinIntegral[d*x]))/(32*a^4)
```

### 3.78.3 Rubi [A] (verified)

Time = 2.05 (sec) , antiderivative size = 791, normalized size of antiderivative = 1.00, number of steps used = 2, number of rules used = 2, $\frac{\text{number of rules}}{\text{integrand size}} = 0.105$, Rules used = {3826, 2009}

Below are the steps used by Rubi to obtain the solution. The rule number used for the transformation is given above next to the arrow. The rules definitions used are listed below.

$$\int \frac{\sin(c+dx)}{x^3 (a+bx^2)^3} \, dx$$

$$\Big\downarrow \ 3826$$

$$\int \left(\frac{3b^2 x \sin(c+dx)}{a^4 (a+bx^2)} - \frac{3b \sin(c+dx)}{a^4 x} + \frac{2b^2 x \sin(c+dx)}{a^3 (a+bx^2)^2} + \frac{\sin(c+dx)}{a^3 x^3} + \frac{b^2 x \sin(c+dx)}{a^2 (a+bx^2)^3}\right) dx$$

$$\Big\downarrow \ 2009$$

$$-\frac{3b\sin(c)\,\text{CosIntegral}(dx)}{a^4}+\frac{3b\sin\left(c-\frac{\sqrt{-a}d}{\sqrt{b}}\right)\text{CosIntegral}\left(xd+\frac{\sqrt{-a}d}{\sqrt{b}}\right)}{2a^4}+\frac{3b\sin\left(\frac{\sqrt{-a}d}{\sqrt{b}}+c\right)\text{CosIntegral}\left(\frac{\sqrt{-a}d}{\sqrt{b}}-dx\right)}{2a^4}-\frac{3b\cos(c)\text{Si}(dx)}{a^4}-\frac{3b\cos\left(\frac{\sqrt{-a}d}{\sqrt{b}}+c\right)\text{Si}\left(\frac{\sqrt{-a}d}{\sqrt{b}}-dx\right)}{2a^4}+\frac{3b\cos\left(c-\frac{\sqrt{-a}d}{\sqrt{b}}\right)\text{Si}\left(xd+\frac{\sqrt{-a}d}{\sqrt{b}}\right)}{2a^4}+\frac{d^2\sin\left(c-\frac{\sqrt{-a}d}{\sqrt{b}}\right)\text{CosIntegral}\left(xd+\frac{\sqrt{-a}d}{\sqrt{b}}\right)}{16a^3}+\frac{d^2\sin\left(\frac{\sqrt{-a}d}{\sqrt{b}}+c\right)\text{CosIntegral}\left(\frac{\sqrt{-a}d}{\sqrt{b}}-dx\right)}{16a^3}-\frac{d^2\cos\left(\frac{\sqrt{-a}d}{\sqrt{b}}+c\right)\text{Si}\left(\frac{\sqrt{-a}d}{\sqrt{b}}-dx\right)}{16a^3}+\frac{d^2\cos\left(c-\frac{\sqrt{-a}d}{\sqrt{b}}\right)\text{Si}\left(xd+\frac{\sqrt{-a}d}{\sqrt{b}}\right)}{16a^3}-\frac{b\sin(c+dx)}{a^3(a+bx^2)}-\frac{\sqrt{b}d\cos(c+dx)}{16a^3\left(\sqrt{-a}-\sqrt{b}x\right)}+\frac{\sqrt{b}d\cos(c+dx)}{16a^3\left(\sqrt{-a}+\sqrt{b}x\right)}-\frac{d^2\sin(c)\,\text{CosIntegral}(dx)}{2a^3}-\frac{d^2\cos(c)\text{Si}(dx)}{2a^3}-\frac{\sin(c+dx)}{2a^3x^2}-\frac{d\cos(c+dx)}{2a^3x}-\frac{b\sin(c+dx)}{4a^2\left(a+bx^2\right)^2}-\frac{9\sqrt{b}d\cos\left(\frac{\sqrt{-a}d}{\sqrt{b}}+c\right)\text{CosIntegral}\left(\frac{\sqrt{-a}d}{\sqrt{b}}-dx\right)}{16(-a)^{7/2}}+\frac{9\sqrt{b}d\cos\left(c-\frac{\sqrt{-a}d}{\sqrt{b}}\right)\text{CosIntegral}\left(xd+\frac{\sqrt{-a}d}{\sqrt{b}}\right)}{16(-a)^{7/2}}-\frac{9\sqrt{b}d\sin\left(\frac{\sqrt{-a}d}{\sqrt{b}}+c\right)\text{Si}\left(\frac{\sqrt{-a}d}{\sqrt{b}}-dx\right)}{16(-a)^{7/2}}-\frac{9\sqrt{b}d\sin\left(c-\frac{\sqrt{-a}d}{\sqrt{b}}\right)\text{Si}\left(xd+\frac{\sqrt{-a}d}{\sqrt{b}}\right)}{16(-a)^{7/2}}$$

input
```
Int[Sin[c + d*x]/(x^3*(a + b*x^2)^3),x]
```

3.78. $\int \frac{\sin(c+dx)}{x^3(a+bx^2)^3}\,dx$

output
```
-1/2*(d*Cos[c + d*x])/(a^3*x) - (Sqrt[b]*d*Cos[c + d*x])/(16*a^3*(Sqrt[-a]
 - Sqrt[b]*x)) + (Sqrt[b]*d*Cos[c + d*x])/(16*a^3*(Sqrt[-a] + Sqrt[b]*x))
- (9*Sqrt[b]*d*Cos[c + (Sqrt[-a]*d)/Sqrt[b]]*CosIntegral[(Sqrt[-a]*d)/Sqrt
[b] - d*x])/(16*(-a)^(7/2)) + (9*Sqrt[b]*d*Cos[c - (Sqrt[-a]*d)/Sqrt[b]]*C
osIntegral[(Sqrt[-a]*d)/Sqrt[b] + d*x])/(16*(-a)^(7/2)) - (3*b*CosIntegral
[d*x]*Sin[c])/a^4 - (d^2*CosIntegral[d*x]*Sin[c])/(2*a^3) + (3*b*CosIntegr
al[(Sqrt[-a]*d)/Sqrt[b] + d*x]*Sin[c - (Sqrt[-a]*d)/Sqrt[b]])/(2*a^4) + (d
^2*CosIntegral[(Sqrt[-a]*d)/Sqrt[b] + d*x]*Sin[c - (Sqrt[-a]*d)/Sqrt[b]])/
(16*a^3) + (3*b*CosIntegral[(Sqrt[-a]*d)/Sqrt[b] - d*x]*Sin[c + (Sqrt[-a]*
d)/Sqrt[b]])/(2*a^4) + (d^2*CosIntegral[(Sqrt[-a]*d)/Sqrt[b] - d*x]*Sin[c
+ (Sqrt[-a]*d)/Sqrt[b]])/(16*a^3) - Sin[c + d*x]/(2*a^3*x^2) - (b*Sin[c +
d*x])/(4*a^2*(a + b*x^2)^2) - (b*Sin[c + d*x])/(a^3*(a + b*x^2)) - (3*b*Co
s[c]*SinIntegral[d*x])/a^4 - (d^2*Cos[c]*SinIntegral[d*x])/(2*a^3) - (3*b*
Cos[c + (Sqrt[-a]*d)/Sqrt[b]]*SinIntegral[(Sqrt[-a]*d)/Sqrt[b] - d*x])/(2*
a^4) - (d^2*Cos[c + (Sqrt[-a]*d)/Sqrt[b]]*SinIntegral[(Sqrt[-a]*d)/Sqrt[b]
 - d*x])/(16*a^3) - (9*Sqrt[b]*d*Sin[c + (Sqrt[-a]*d)/Sqrt[b]]*SinIntegral
[(Sqrt[-a]*d)/Sqrt[b] - d*x])/(16*(-a)^(7/2)) + (3*b*Cos[c - (Sqrt[-a]*d)/
Sqrt[b]]*SinIntegral[(Sqrt[-a]*d)/Sqrt[b] + d*x])/(2*a^4) + (d^2*Cos[c - (
Sqrt[-a]*d)/Sqrt[b]]*SinIntegral[(Sqrt[-a]*d)/Sqrt[b] + d*x])/(16*a^3) - (
9*Sqrt[b]*d*Sin[c - (Sqrt[-a]*d)/Sqrt[b]]*SinIntegral[(Sqrt[-a]*d)/Sqrt...
```

### 3.78.3.1 Defintions of rubi rules used

rule 2009
```
Int[u_, x_Symbol] :> Simp[IntSum[u, x], x] /; SumQ[u]
```

rule 3826
```
Int[(x_)^(m_.)*((a_) + (b_.)*(x_)^(n_))^(p_)*Sin[(c_.) + (d_.)*(x_)], x_Sym
bol] :> Int[ExpandIntegrand[Sin[c + d*x], x^m*(a + b*x^n)^p, x], x] /; Free
Q[{a, b, c, d, m}, x] && ILtQ[p, 0] && IGtQ[n, 0] && (EqQ[n, 2] || EqQ[p, -
1]) && IntegerQ[m]
```

### 3.78.4 Maple [A] (verified)

Time = 1.75 (sec) , antiderivative size = 697, normalized size of antiderivative = 0.88

| method | result |
|---|---|
| derivativedivides | $d^2\left(-\frac{\sin(dx+c)\left(2a^2d^4+9ab\,c^2d^2-18abc\,d^2(dx+c)+9ab\,d^2(dx+c)^2+6b^2c^4-24b^2c^3(dx+c)+36b^2c^2(dx+c)^2-24b^2c(d\right.}{4a^3d^2x^2\left(a\,d^2+c^2b-2bc(dx+c)+b(dx+c)^2\right)^2}\right.$ |
| default | $d^2\left(-\frac{\sin(dx+c)\left(2a^2d^4+9ab\,c^2d^2-18abc\,d^2(dx+c)+9ab\,d^2(dx+c)^2+6b^2c^4-24b^2c^3(dx+c)+36b^2c^2(dx+c)^2-24b^2c(d\right.}{4a^3d^2x^2\left(a\,d^2+c^2b-2bc(dx+c)+b(dx+c)^2\right)^2}\right.$ |
| risch | $-\frac{id^2\mathrm{e}^{-\frac{icb-d\sqrt{ab}}{b}}\mathrm{Ei}_1\left(-\frac{icb-d\sqrt{ab}-b(idx+ic)}{b}\right)}{32a^3}-\frac{9id\,\mathrm{e}^{\frac{icb+d\sqrt{ab}}{b}}\mathrm{Ei}_1\left(\frac{icb+d\sqrt{ab}-b(idx+ic)}{b}\right)b}{32a^3\sqrt{ab}}+\frac{9id\,\mathrm{e}^{\frac{icb-d\sqrt{ab}}{b}}\mathrm{Ei}_1\left(\frac{ic}{}\right.}{32a^3}$ |

input
```
int(sin(d*x+c)/x^3/(b*x^2+a)^3,x,method=_RETURNVERBOSE)
```

output
```
d^2*(-1/4*sin(d*x+c)*(2*a^2*d^4+9*a*b*c^2*d^2-18*a*b*c*d^2*(d*x+c)+9*a*b*d
^2*(d*x+c)^2+6*b^2*c^4-24*b^2*c^3*(d*x+c)+36*b^2*c^2*(d*x+c)^2-24*b^2*c*(d
*x+c)^3+6*b^2*(d*x+c)^4)/a^3/d^2/x^2/(a*d^2+c^2*b-2*b*c*(d*x+c)+b*(d*x+c)^
2)^2-1/8*cos(d*x+c)*(4*a*d^2+3*c^2*b-6*b*c*(d*x+c)+3*b*(d*x+c)^2)/a^3/d/x/
(a*d^2+c^2*b-2*b*c*(d*x+c)+b*(d*x+c)^2)+1/16*(a*d^2+24*b)/d^2/a^4*(Si(d*x+
c-(d*(-a*b)^(1/2)+c*b)/b)*cos((d*(-a*b)^(1/2)+c*b)/b)+Ci(d*x+c-(d*(-a*b)^(
1/2)+c*b)/b)*sin((d*(-a*b)^(1/2)+c*b)/b))+1/16*(a*d^2+24*b)/d^2/a^4*(Si(d*
x+c+(d*(-a*b)^(1/2)-c*b)/b)*cos((d*(-a*b)^(1/2)-c*b)/b)-Ci(d*x+c+(d*(-a*b)
^(1/2)-c*b)/b)*sin((d*(-a*b)^(1/2)-c*b)/b))-1/2/a^4*(a*d^2+6*b)/d^2*(Si(d*
x)*cos(c)+Ci(d*x)*sin(c))-9/16/a^3/(-(d*(-a*b)^(1/2)+c*b)/b+c)*(-Si(d*x+c-
(d*(-a*b)^(1/2)+c*b)/b)*sin((d*(-a*b)^(1/2)+c*b)/b)+Ci(d*x+c-(d*(-a*b)^(1/
2)+c*b)/b)*cos((d*(-a*b)^(1/2)+c*b)/b))-9/16/a^3/((d*(-a*b)^(1/2)-c*b)/b+c
)*(Si(d*x+c+(d*(-a*b)^(1/2)-c*b)/b)*sin((d*(-a*b)^(1/2)-c*b)/b)+Ci(d*x+c+(
d*(-a*b)^(1/2)-c*b)/b)*cos((d*(-a*b)^(1/2)-c*b)/b)))
```

### 3.78.5 Fricas [C] (verification not implemented)

Result contains complex when optimal does not.

Time = 0.31 (sec) , antiderivative size = 758, normalized size of antiderivative = 0.96

$$\int\frac{\sin(c+dx)}{x^3\left(a+bx^2\right)^3}\,dx=$$

$$-\frac{\left(i\left(ab^2d^2+24\,b^3\right)x^6+2i\left(a^2bd^2+24\,ab^2\right)x^4+i\left(a^3d^2+24\,a^2b\right)x^2+9\left(-i\,b^3x^6-2i\,ab^2x^4-i\,a^2bx^2\right)\sqrt{\right.}{}$$

input
```
integrate(sin(d*x+c)/x^3/(b*x^2+a)^3,x, algorithm="fricas")
```

output
```
-1/32*((I*(a*b^2*d^2 + 24*b^3)*x^6 + 2*I*(a^2*b*d^2 + 24*a*b^2)*x^4 + I*(a
^3*d^2 + 24*a^2*b)*x^2 + 9*(-I*b^3*x^6 - 2*I*a*b^2*x^4 - I*a^2*b*x^2)*sqrt
(a*d^2/b))*Ei(I*d*x - sqrt(a*d^2/b))*e^(I*c + sqrt(a*d^2/b)) + (I*(a*b^2*d
^2 + 24*b^3)*x^6 + 2*I*(a^2*b*d^2 + 24*a*b^2)*x^4 + I*(a^3*d^2 + 24*a^2*b)
*x^2 + 9*(I*b^3*x^6 + 2*I*a*b^2*x^4 + I*a^2*b*x^2)*sqrt(a*d^2/b))*Ei(I*d*x
 + sqrt(a*d^2/b))*e^(I*c - sqrt(a*d^2/b)) + (-I*(a*b^2*d^2 + 24*b^3)*x^6 -
 2*I*(a^2*b*d^2 + 24*a*b^2)*x^4 - I*(a^3*d^2 + 24*a^2*b)*x^2 + 9*(I*b^3*x^
6 + 2*I*a*b^2*x^4 + I*a^2*b*x^2)*sqrt(a*d^2/b))*Ei(-I*d*x - sqrt(a*d^2/b))
*e^(-I*c + sqrt(a*d^2/b)) + (-I*(a*b^2*d^2 + 24*b^3)*x^6 - 2*I*(a^2*b*d^2
+ 24*a*b^2)*x^4 - I*(a^3*d^2 + 24*a^2*b)*x^2 + 9*(-I*b^3*x^6 - 2*I*a*b^2*x
^4 - I*a^2*b*x^2)*sqrt(a*d^2/b))*Ei(-I*d*x + sqrt(a*d^2/b))*e^(-I*c - sqrt
(a*d^2/b)) + 16*((a*b^2*d^2 + 6*b^3)*x^6 + 2*(a^2*b*d^2 + 6*a*b^2)*x^4 + (
a^3*d^2 + 6*a^2*b)*x^2)*cos_integral(d*x)*sin(c) + 16*((a*b^2*d^2 + 6*b^3)
*x^6 + 2*(a^2*b*d^2 + 6*a*b^2)*x^4 + (a^3*d^2 + 6*a^2*b)*x^2)*cos(c)*sin_i
ntegral(d*x) + 4*(3*a*b^2*d*x^5 + 7*a^2*b*d*x^3 + 4*a^3*d*x)*cos(d*x + c)
+ 8*(6*a*b^2*x^4 + 9*a^2*b*x^2 + 2*a^3)*sin(d*x + c))/(a^4*b^2*x^6 + 2*a^5
*b*x^4 + a^6*x^2)
```

### 3.78.6 Sympy [F(-1)]

Timed out.

$$\int \frac{\sin(c+dx)}{x^3\left(a+bx^2\right)^3}\,dx = \text{Timed out}$$

input
```
integrate(sin(d*x+c)/x**3/(b*x**2+a)**3,x)
```

output
```
Timed out
```

### 3.78.7 Maxima [F]

$$\int \frac{\sin(c+dx)}{x^3 (a+bx^2)^3} \, dx = \int \frac{\sin(dx+c)}{(bx^2+a)^3 x^3} \, dx$$

input
```
integrate(sin(d*x+c)/x^3/(b*x^2+a)^3,x, algorithm="maxima")
```

output
```
integrate(sin(d*x + c)/((b*x^2 + a)^3*x^3), x)
```

### 3.78.8 Giac [F]

$$\int \frac{\sin(c+dx)}{x^3 (a+bx^2)^3} \, dx = \int \frac{\sin(dx+c)}{(bx^2+a)^3 x^3} \, dx$$

input
```
integrate(sin(d*x+c)/x^3/(b*x^2+a)^3,x, algorithm="giac")
```

output
```
integrate(sin(d*x + c)/((b*x^2 + a)^3*x^3), x)
```

### 3.78.9 Mupad [F(-1)]

Timed out.

$$\int \frac{\sin(c+dx)}{x^3 (a+bx^2)^3} \, dx = \int \frac{\sin(c+d\,x)}{x^3 (b\,x^2+a)^3} \, dx$$

input
```
int(sin(c + d*x)/(x^3*(a + b*x^2)^3),x)
```

output
```
int(sin(c + d*x)/(x^3*(a + b*x^2)^3), x)
```

# 3.79 $\int x^3(a+bx^3)\sin(c+dx)\,dx$



## 3.79.1 Optimal result

Integrand size = 17, antiderivative size = 156

$$\int x^3\left(a+bx^3\right)\sin(c+dx)\,dx=\frac{720b\cos(c+dx)}{d^7}+\frac{6ax\cos(c+dx)}{d^3}-\frac{360bx^2\cos(c+dx)}{d^5}-\frac{ax^3\cos(c+dx)}{d}+\frac{30bx^4\cos(c+dx)}{d^3}-\frac{bx^6\cos(c+dx)}{d}-\frac{6a\sin(c+dx)}{d^4}+\frac{720bx\sin(c+dx)}{d^6}+\frac{3ax^2\sin(c+dx)}{d^2}-\frac{120bx^3\sin(c+dx)}{d^4}+\frac{6bx^5\sin(c+dx)}{d^2}$$

output
```
720*b*cos(d*x+c)/d^7+6*a*x*cos(d*x+c)/d^3-360*b*x^2*cos(d*x+c)/d^5-a*x^3*c
os(d*x+c)/d+30*b*x^4*cos(d*x+c)/d^3-b*x^6*cos(d*x+c)/d-6*a*sin(d*x+c)/d^4+
720*b*x*sin(d*x+c)/d^6+3*a*x^2*sin(d*x+c)/d^2-120*b*x^3*sin(d*x+c)/d^4+6*b
*x^5*sin(d*x+c)/d^2
```

## 3.79.2 Mathematica [A] (verified)

Time = 0.15 (sec) , antiderivative size = 101, normalized size of antiderivative = 0.65

$$\int x^3\left(a+bx^3\right)\sin(c+dx)\,dx=\frac{-((ad^4x(-6+d^2x^2)+b(-720+360d^2x^2-30d^4x^4+d^6x^6))\cos(c+dx))+3d(ad^2(-2+d^2x^2)+2bx(12}{d^7}$$

input
```
Integrate[x^3*(a + b*x^3)*Sin[c + d*x],x]
```

output
```
(-((a*d^4*x*(-6 + d^2*x^2) + b*(-720 + 360*d^2*x^2 - 30*d^4*x^4 + d^6*x^6)
)*Cos[c + d*x]) + 3*d*(a*d^2*(-2 + d^2*x^2) + 2*b*x*(120 - 20*d^2*x^2 + d^
4*x^4))*Sin[c + d*x])/d^7
```

### 3.79.3 Rubi [A] (verified)

Time = 0.44 (sec) , antiderivative size = 156, normalized size of antiderivative = 1.00, number of steps used = 2, number of rules used = 2, $\frac{\text{number of rules}}{\text{integrand size}} = 0.118$, Rules used = {3820, 2009}

Below are the steps used by Rubi to obtain the solution. The rule number used for the transformation is given above next to the arrow. The rules definitions used are listed below.

$$\int x^3 \left(a+bx^3\right) \sin(c+dx) \, dx$$

$$\Big\downarrow \text{ 3820}$$

$$\int \left(ax^3 \sin(c+dx)+bx^6 \sin(c+dx)\right) dx$$

$$\Big\downarrow \text{ 2009}$$

$$-\frac{6a\sin(c+dx)}{d^4}+\frac{6ax\cos(c+dx)}{d^3}+\frac{3ax^2\sin(c+dx)}{d^2}-\frac{ax^3\cos(c+dx)}{d}+\frac{720b\cos(c+dx)}{d^7}+\frac{720bx\sin(c+dx)}{d^6}-\frac{360bx^2\cos(c+dx)}{d^5}-\frac{120bx^3\sin(c+dx)}{d^4}+\frac{30bx^4\cos(c+dx)}{d^3}+\frac{6bx^5\sin(c+dx)}{d^2}-\frac{bx^6\cos(c+dx)}{d}$$

input
```
Int[x^3*(a + b*x^3)*Sin[c + d*x],x]
```

output
```
(720*b*Cos[c + d*x])/d^7 + (6*a*x*Cos[c + d*x])/d^3 - (360*b*x^2*Cos[c + d
*x])/d^5 - (a*x^3*Cos[c + d*x])/d + (30*b*x^4*Cos[c + d*x])/d^3 - (b*x^6*C
os[c + d*x])/d - (6*a*Sin[c + d*x])/d^4 + (720*b*x*Sin[c + d*x])/d^6 + (3*
a*x^2*Sin[c + d*x])/d^2 - (120*b*x^3*Sin[c + d*x])/d^4 + (6*b*x^5*Sin[c +
d*x])/d^2
```

### 3.79.3.1 Defintions of rubi rules used

rule 2009
```
Int[u_, x_Symbol] :> Simp[IntSum[u, x], x] /; SumQ[u]
```

rule 3820
```
Int[((e_.)*(x_))^(m_.)*((a_) + (b_.)*(x_)^(n_))^(p_.)*Sin[(c_.) + (d_.)*(x_
)], x_Symbol] :> Int[ExpandIntegrand[Sin[c + d*x], (e*x)^m*(a + b*x^n)^p, x
], x] /; FreeQ[{a, b, c, d, e, m, n}, x] && IGtQ[p, 0]
```

## 3.79.4 Maple [A] (verified)

Time = 0.17 (sec) , antiderivative size = 106, normalized size of antiderivative = 0.68

| method | result |
|---|---|
| risch | $-\frac{(b x^6 d^6+a d^6 x^3-30 b x^4 d^4-6 a d^4 x+360 d^2 x^2 b-720 b)\cos(dx+c)}{d^7}+\frac{3(2b d^4 x^5+a d^4 x^2-40 b d^2 x^3-2a d^2+240 b x)\sin\cdots}{d^6}$ |
| parallelrisch | $\frac{(x^3(b x^3+a)d^6-6x(5b x^3+a)d^4+360 d^2 x^2 b-1440 b)\left(\tan^2\left(\frac{dx}{2}+\frac{c}{2}\right)\right)+6(x^2(2b x^3+a)d^4+(-40 b x^3-2a)d^2+240 b x)d\,\mathrm{ta}\cdots}{d^7\left(1+\tan^2\left(\frac{dx}{2}+\frac{c}{2}\right)\right)}$ |
| norman | $\frac{\frac{1440 b}{d^7}+\frac{a x^3\left(\tan^2\left(\frac{dx}{2}+\frac{c}{2}\right)\right)}{d}+\frac{b x^6\left(\tan^2\left(\frac{dx}{2}+\frac{c}{2}\right)\right)}{d}-\frac{12 a\tan\left(\frac{dx}{2}+\frac{c}{2}\right)}{d^4}+\frac{6 a x}{d^3}-\frac{a x^3}{d}-\frac{360 b x^2}{d^5}+\frac{30 b x^4}{d^3}-\frac{b x^6}{d}-\frac{6 a x\left(\tan^2\left(\frac{dx}{2}+\frac{c}{2}\cdots\right.\right.}{d^3}}{1+\cdots}$ |
| meijerg | $\frac{64 b\sqrt{\pi}\sin(c)\left(\frac{x(d^2)^{\frac{7}{2}}\left(\frac{21}{8}d^4x^4-\frac{105}{2}d^2x^2+315\right)\cos(dx)}{28\sqrt{\pi}\,d^6}-\frac{(d^2)^{\frac{7}{2}}\left(-\frac{7}{16}d^6x^6+\frac{105}{8}d^4x^4-\frac{315}{2}d^2x^2+315\right)\sin(dx)}{28\sqrt{\pi}\,d^7}\right)}{d^6\sqrt{d^2}}+\frac{64 b\sqrt{\pi}\cdots}{\cdots}$ |
| parts | $-\frac{b x^6\cos(dx+c)}{d}-\frac{a x^3\cos(dx+c)}{d}+\frac{\frac{3 a c^2\sin(dx+c)}{d^2}-\frac{6 a c(\cos(dx+c)+(dx+c)\sin(dx+c))}{d^2}+\frac{3a\left((dx+c)^2\sin(dx+c)-2\sin(d\cdots\right.}{d^2}\cdots}{\cdots}$ |
| derivativedivides | $\frac{a c^3\cos(dx+c)+3 a c^2(\sin(dx+c)-\cos(dx+c)(dx+c))-3 a c\left(-(dx+c)^2\cos(dx+c)+2\cos(dx+c)+2(dx+c)\sin(dx+c)\right)+a\cdots}{\cdots}$ |
| default | $\frac{a c^3\cos(dx+c)+3 a c^2(\sin(dx+c)-\cos(dx+c)(dx+c))-3 a c\left(-(dx+c)^2\cos(dx+c)+2\cos(dx+c)+2(dx+c)\sin(dx+c)\right)+a\cdots}{\cdots}$ |

input
```
int(x^3*(b*x^3+a)*sin(d*x+c),x,method=_RETURNVERBOSE)
```

output
```
-(b*d^6*x^6+a*d^6*x^3-30*b*d^4*x^4-6*a*d^4*x+360*b*d^2*x^2-720*b)/d^7*cos(
d*x+c)+3/d^6*(2*b*d^4*x^5+a*d^4*x^2-40*b*d^2*x^3-2*a*d^2+240*b*x)*sin(d*x+
c)
```

### 3.79.5 Fricas [A] (verification not implemented)

Time = 0.28 (sec) , antiderivative size = 104, normalized size of antiderivative = 0.67

$$\int x^3(a+bx^3)\sin(c+dx)\,dx =$$
$$-\frac{(bd^6x^6+ad^6x^3-30\,bd^4x^4-6\,ad^4x+360\,bd^2x^2-720\,b)\cos(dx+c)-3\,(2\,bd^5x^5+ad^5x^2-40\,bd^3x^3}{d^7}$$

input
```
integrate(x^3*(b*x^3+a)*sin(d*x+c),x, algorithm="fricas")
```

output
```
-((b*d^6*x^6 + a*d^6*x^3 - 30*b*d^4*x^4 - 6*a*d^4*x + 360*b*d^2*x^2 - 720*
b)*cos(d*x + c) - 3*(2*b*d^5*x^5 + a*d^5*x^2 - 40*b*d^3*x^3 - 2*a*d^3 + 24
0*b*d*x)*sin(d*x + c))/d^7
```

### 3.79.6 Sympy [A] (verification not implemented)

Time = 0.55 (sec) , antiderivative size = 185, normalized size of antiderivative = 1.19

$$\int x^3(a+bx^3)\sin(c+dx)\,dx$$
$$=\begin{cases} -\frac{ax^3\cos(c+dx)}{d}+\frac{3ax^2\sin(c+dx)}{d^2}+\frac{6ax\cos(c+dx)}{d^3}-\frac{6a\sin(c+dx)}{d^4}-\frac{bx^6\cos(c+dx)}{d}+\frac{6bx^5\sin(c+dx)}{d^2}+\frac{30bx^4\cos(c+dx)}{d^3}- \\ \left(\frac{ax^4}{4}+\frac{bx^7}{7}\right)\sin(c) \end{cases}$$

input
```
integrate(x**3*(b*x**3+a)*sin(d*x+c),x)
```

output
```
Piecewise((-a*x**3*cos(c + d*x)/d + 3*a*x**2*sin(c + d*x)/d**2 + 6*a*x*cos
(c + d*x)/d**3 - 6*a*sin(c + d*x)/d**4 - b*x**6*cos(c + d*x)/d + 6*b*x**5*
sin(c + d*x)/d**2 + 30*b*x**4*cos(c + d*x)/d**3 - 120*b*x**3*sin(c + d*x)/
d**4 - 360*b*x**2*cos(c + d*x)/d**5 + 720*b*x*sin(c + d*x)/d**6 + 720*b*co
s(c + d*x)/d**7, Ne(d, 0)), ((a*x**4/4 + b*x**7/7)*sin(c), True))
```

### 3.79.7 Maxima [B] (verification not implemented)

Leaf count of result is larger than twice the leaf count of optimal. 449 vs. $2(156) = 312$.

Time = 0.22 (sec) , antiderivative size = 449, normalized size of antiderivative = 2.88

$$\int x^3(a+bx^3)\sin(c+dx)\,dx$$

$$= \frac{ac^3\cos(dx+c) - \frac{bc^6\cos(dx+c)}{d^3} - 3((dx+c)\cos(dx+c) - \sin(dx+c))ac^2 + \frac{6((dx+c)\cos(dx+c)-\sin(dx+c))bc^5}{d^3} -}{}$$

input
```
integrate(x^3*(b*x^3+a)*sin(d*x+c),x, algorithm="maxima")
```

output
```
(a*c^3*cos(d*x + c) - b*c^6*cos(d*x + c)/d^3 - 3*((d*x + c)*cos(d*x + c) -
 sin(d*x + c))*a*c^2 + 6*((d*x + c)*cos(d*x + c) - sin(d*x + c))*b*c^5/d^3
 + 3*(((d*x + c)^2 - 2)*cos(d*x + c) - 2*(d*x + c)*sin(d*x + c))*a*c - 15*
(((d*x + c)^2 - 2)*cos(d*x + c) - 2*(d*x + c)*sin(d*x + c))*b*c^4/d^3 - ((
(d*x + c)^3 - 6*d*x - 6*c)*cos(d*x + c) - 3*((d*x + c)^2 - 2)*sin(d*x + c)
)*a + 20*(((d*x + c)^3 - 6*d*x - 6*c)*cos(d*x + c) - 3*((d*x + c)^2 - 2)*s
in(d*x + c))*b*c^3/d^3 - 15*(((d*x + c)^4 - 12*(d*x + c)^2 + 24)*cos(d*x +
 c) - 4*((d*x + c)^3 - 6*d*x - 6*c)*sin(d*x + c))*b*c^2/d^3 + 6*(((d*x + c
)^5 - 20*(d*x + c)^3 + 120*d*x + 120*c)*cos(d*x + c) - 5*((d*x + c)^4 - 12
*(d*x + c)^2 + 24)*sin(d*x + c))*b*c/d^3 - (((d*x + c)^6 - 30*(d*x + c)^4
+ 360*(d*x + c)^2 - 720)*cos(d*x + c) - 6*((d*x + c)^5 - 20*(d*x + c)^3 +
120*d*x + 120*c)*sin(d*x + c))*b/d^3)/d^4
```

### 3.79.8 Giac [A] (verification not implemented)

Time = 0.33 (sec) , antiderivative size = 106, normalized size of antiderivative = 0.68

$$\int x^3(a+bx^3)\sin(c+dx)\,dx$$
$$= -\frac{(bd^6x^6 + ad^6x^3 - 30\,bd^4x^4 - 6\,ad^4x + 360\,bd^2x^2 - 720\,b)\cos(dx+c)}{d^7} + \frac{3\,(2\,bd^5x^5 + ad^5x^2 - 40\,bd^3x^3 - 2\,ad^3 + 240\,bdx)\sin(dx+c)}{d^7}$$

input
```
integrate(x^3*(b*x^3+a)*sin(d*x+c),x, algorithm="giac")
```

output
```
-(b*d^6*x^6 + a*d^6*x^3 - 30*b*d^4*x^4 - 6*a*d^4*x + 360*b*d^2*x^2 - 720*b
)*cos(d*x + c)/d^7 + 3*(2*b*d^5*x^5 + a*d^5*x^2 - 40*b*d^3*x^3 - 2*a*d^3 +
 240*b*d*x)*sin(d*x + c)/d^7
```

### 3.79.9 Mupad [B] (verification not implemented)

Time = 0.72 (sec) , antiderivative size = 151, normalized size of antiderivative = 0.97

$$\int x^3(a+bx^3)\sin(c+dx)\,dx$$
$$= \frac{d^4\,(6\,a\,x\,\cos(c+d\,x)+30\,b\,x^4\,\cos(c+d\,x))+720\,b\,\cos(c+d\,x)-d^6\,(a\,x^3\,\cos(c+d\,x)+b\,x^6\,\cos(c+}{}$$

input
```
int(x^3*sin(c + d*x)*(a + b*x^3),x)
```

output
```
(d^4*(6*a*x*cos(c + d*x) + 30*b*x^4*cos(c + d*x)) + 720*b*cos(c + d*x) - d
^6*(a*x^3*cos(c + d*x) + b*x^6*cos(c + d*x)) + d^5*(3*a*x^2*sin(c + d*x) +
 6*b*x^5*sin(c + d*x)) - d^3*(6*a*sin(c + d*x) + 120*b*x^3*sin(c + d*x)) +
 720*b*d*x*sin(c + d*x) - 360*b*d^2*x^2*cos(c + d*x))/d^7
```

# 3.80 $\int x^2(a+bx^3)\sin(c+dx)\,dx$



## 3.80.1 Optimal result

Integrand size = 17, antiderivative size = 126

$$\int x^2(a+bx^3)\sin(c+dx)\,dx = \frac{2a\cos(c+dx)}{d^3}-\frac{120bx\cos(c+dx)}{d^5}-\frac{ax^2\cos(c+dx)}{d}+\frac{20bx^3\cos(c+dx)}{d^3}-\frac{bx^5\cos(c+dx)}{d}+\frac{120b\sin(c+dx)}{d^6}+\frac{2ax\sin(c+dx)}{d^2}-\frac{60bx^2\sin(c+dx)}{d^4}+\frac{5bx^4\sin(c+dx)}{d^2}$$

output
```
2*a*cos(d*x+c)/d^3-120*b*x*cos(d*x+c)/d^5-a*x^2*cos(d*x+c)/d+20*b*x^3*cos(
d*x+c)/d^3-b*x^5*cos(d*x+c)/d+120*b*sin(d*x+c)/d^6+2*a*x*sin(d*x+c)/d^2-60
*b*x^2*sin(d*x+c)/d^4+5*b*x^4*sin(d*x+c)/d^2
```

## 3.80.2 Mathematica [A] (verified)

Time = 0.09 (sec) , antiderivative size = 84, normalized size of antiderivative = 0.67

$$\int x^2(a+bx^3)\sin(c+dx)\,dx = \frac{-d(ad^2(-2+d^2x^2)+bx(120-20d^2x^2+d^4x^4))\cos(c+dx)+(2ad^4x+5b(24-12d^2x^2+d^4x^4))\sin(c+}{d^6}$$

input
```
Integrate[x^2*(a + b*x^3)*Sin[c + d*x],x]
```

output
```
(-(d*(a*d^2*(-2 + d^2*x^2) + b*x*(120 - 20*d^2*x^2 + d^4*x^4))*Cos[c + d*x
]) + (2*a*d^4*x + 5*b*(24 - 12*d^2*x^2 + d^4*x^4))*Sin[c + d*x])/d^6
```

## 3.80.3 Rubi [A] (verified)

Time = 0.37 (sec) , antiderivative size = 126, normalized size of antiderivative = 1.00, number of steps used = 2, number of rules used = 2, $\frac{\text{number of rules}}{\text{integrand size}} = 0.118$, Rules used = {3820, 2009}

Below are the steps used by Rubi to obtain the solution. The rule number used for the transformation is given above next to the arrow. The rules definitions used are listed below.

$$\int x^2 (a + bx^3) \sin(c + dx) \, dx$$

$$\Big\downarrow \text{ 3820}$$

$$\int \left(ax^2 \sin(c + dx) + bx^5 \sin(c + dx)\right) dx$$

$$\Big\downarrow \text{ 2009}$$

$$\frac{2a\cos(c+dx)}{d^3} + \frac{2ax\sin(c+dx)}{d^2} - \frac{ax^2\cos(c+dx)}{d} + \frac{120b\sin(c+dx)}{d^6} - \frac{120bx\cos(c+dx)}{d^5} - \frac{60bx^2\sin(c+dx)}{d^4} + \frac{20bx^3\cos(c+dx)}{d^3} + \frac{5bx^4\sin(c+dx)}{d^2} - \frac{bx^5\cos(c+dx)}{d}$$

input
```
Int[x^2*(a + b*x^3)*Sin[c + d*x],x]
```

output
```
(2*a*Cos[c + d*x])/d^3 - (120*b*x*Cos[c + d*x])/d^5 - (a*x^2*Cos[c + d*x])
/d + (20*b*x^3*Cos[c + d*x])/d^3 - (b*x^5*Cos[c + d*x])/d + (120*b*Sin[c +
 d*x])/d^6 + (2*a*x*Sin[c + d*x])/d^2 - (60*b*x^2*Sin[c + d*x])/d^4 + (5*b
*x^4*Sin[c + d*x])/d^2
```

### 3.80.3.1 Defintions of rubi rules used

rule 2009
```
Int[u_, x_Symbol] :> Simp[IntSum[u, x], x] /; SumQ[u]
```

rule 3820
```
Int[((e_.)*(x_))^(m_.)*((a_) + (b_.)*(x_)^(n_))^(p_.)*Sin[(c_.) + (d_.)*(x_
)], x_Symbol] :> Int[ExpandIntegrand[Sin[c + d*x], (e*x)^m*(a + b*x^n)^p, x
], x] /; FreeQ[{a, b, c, d, e, m, n}, x] && IGtQ[p, 0]
```

### 3.80.4 Maple [A] (verified)

Time = 0.15 (sec) , antiderivative size = 88, normalized size of antiderivative = 0.70

| method | result |
|---|---|
| risch | $-\frac{\left(b\,d^{4}x^{5}+a\,d^{4}x^{2}-20 b\,d^{2}x^{3}-2 a\,d^{2}+120 b x\right)\cos\left(d x+c\right)}{d^{5}}+\frac{\left(5 b\,x^{4}d^{4}+2 a\,d^{4}x-60 d^{2}x^{2}b+120 b\right)\sin\left(d x+c\right)}{d^{6}}$ |
| parallelrisch | $\frac{\left(x\left(b\,x^{3}+a\right)d^{4}-20 d^{2}x^{2}b+120 b\right)x d\left(\tan^{2}\left(\frac{d x}{2}+\frac{c}{2}\right)\right)+\left(\left(10 b\,x^{4}+4 a x\right)d^{4}-120 d^{2}x^{2}b+240 b\right)\tan\left(\frac{d x}{2}+\frac{c}{2}\right)-\left(x^{2}\left(b\,x^{3}+a\right)d^{4}-\right.}{d^{6}\left(1+\tan^{2}\left(\frac{d x}{2}+\frac{c}{2}\right)\right)}$ |
| norman | $\frac{\frac{4a}{d^{3}}+\frac{a\,x^{2}\left(\tan^{2}\left(\frac{d x}{2}+\frac{c}{2}\right)\right)}{d}+\frac{b\,x^{5}\left(\tan^{2}\left(\frac{d x}{2}+\frac{c}{2}\right)\right)}{d}-\frac{a\,x^{2}}{d}+\frac{240 b\tan\left(\frac{d x}{2}+\frac{c}{2}\right)}{d^{6}}-\frac{120 b x}{d^{5}}+\frac{20 b\,x^{3}}{d^{3}}-\frac{b\,x^{5}}{d}+\frac{4 a x\tan\left(\frac{d x}{2}+\frac{c}{2}\right)}{d^{2}}+\frac{120 b x\left(\mathrm{ta}\right.}{}}{1+\tan^{2}\left(\frac{d x}{2}+\frac{c}{2}\right)}$ |
| meijerg | $\frac{32 b\sqrt{\pi}\,\sin\left(c\right)\left(-\frac{15}{4\sqrt{\pi}}+\frac{\left(\frac{15}{8}d^{4}x^{4}-\frac{45}{2}d^{2}x^{2}+45\right)\cos\left(d x\right)}{12\sqrt{\pi}}+\frac{x d\left(\frac{3}{8}d^{4}x^{4}-\frac{15}{2}d^{2}x^{2}+45\right)\sin\left(d x\right)}{12\sqrt{\pi}}\right)}{d^{6}}+\frac{32 b\sqrt{\pi}\,\cos\left(c\right)\left(-\frac{x d\left(\frac{7}{8}d^{4}x^{4}\right.}{}\right.}{}$ |
| parts | $-\frac{b\,x^{5}\cos\left(d x+c\right)}{d}-\frac{a\,x^{2}\cos\left(d x+c\right)}{d}+\frac{-\frac{2 a c\sin\left(d x+c\right)}{d}+\frac{2 a\left(\cos\left(d x+c\right)+\left(d x+c\right)\sin\left(d x+c\right)\right)}{d}+\frac{5 b\,c^{4}\sin\left(d x+c\right)}{d^{4}}-\frac{20 b\,c^{3}\left(\cos(d x\right.}{}}{}$ |
| derivativedivides | $\frac{-a\,c^{2}\cos\left(d x+c\right)-2 a c\left(\sin\left(d x+c\right)-\cos\left(d x+c\right)\left(d x+c\right)\right)+a\left(-\left(d x+c\right)^{2}\cos\left(d x+c\right)+2\cos\left(d x+c\right)+2\left(d x+c\right)\sin\left(d x+c\right)\right)+\frac{b\,c}{}}{}$ |
| default | $\frac{-a\,c^{2}\cos\left(d x+c\right)-2 a c\left(\sin\left(d x+c\right)-\cos\left(d x+c\right)\left(d x+c\right)\right)+a\left(-\left(d x+c\right)^{2}\cos\left(d x+c\right)+2\cos\left(d x+c\right)+2\left(d x+c\right)\sin\left(d x+c\right)\right)+\frac{b\,c}{}}{}$ |

input
```
int(x^2*(b*x^3+a)*sin(d*x+c),x,method=_RETURNVERBOSE)
```

output
```
-1/d^5*(b*d^4*x^5+a*d^4*x^2-20*b*d^2*x^3-2*a*d^2+120*b*x)*cos(d*x+c)+(5*b*
d^4*x^4+2*a*d^4*x-60*b*d^2*x^2+120*b)/d^6*sin(d*x+c)
```

### 3.80.5 Fricas [A] (verification not implemented)

Time = 0.26 (sec) , antiderivative size = 87, normalized size of antiderivative = 0.69

$$\int x^2\left(a+bx^3\right)\sin(c+dx)\,dx =$$
$$-\frac{\left(bd^5x^5+ad^5x^2-20\,bd^3x^3-2\,ad^3+120\,bdx\right)\cos\left(dx+c\right)-\left(5\,bd^4x^4+2\,ad^4x-60\,bd^2x^2+120\,b\right)\sin\left(\right.}{d^6}$$

input
```
integrate(x^2*(b*x^3+a)*sin(d*x+c),x, algorithm="fricas")
```

output
```
-((b*d^5*x^5 + a*d^5*x^2 - 20*b*d^3*x^3 - 2*a*d^3 + 120*b*d*x)*cos(d*x + c
) - (5*b*d^4*x^4 + 2*a*d^4*x - 60*b*d^2*x^2 + 120*b)*sin(d*x + c))/d^6
```

### 3.80.6 Sympy [A] (verification not implemented)

Time = 0.43 (sec) , antiderivative size = 151, normalized size of antiderivative = 1.20

$$\int x^2(a+bx^3)\sin(c+dx)\,dx$$
$$=\begin{cases}-\frac{ax^2\cos(c+dx)}{d}+\frac{2ax\sin(c+dx)}{d^2}+\frac{2a\cos(c+dx)}{d^3}-\frac{bx^5\cos(c+dx)}{d}+\frac{5bx^4\sin(c+dx)}{d^2}+\frac{20bx^3\cos(c+dx)}{d^3}-\frac{60bx^2\sin(c+dx)}{d^4}- \\ \left(\frac{ax^3}{3}+\frac{bx^6}{6}\right)\sin(c)\end{cases}$$

input
```
integrate(x**2*(b*x**3+a)*sin(d*x+c),x)
```

output
```
Piecewise((-a*x**2*cos(c + d*x)/d + 2*a*x*sin(c + d*x)/d**2 + 2*a*cos(c +
d*x)/d**3 - b*x**5*cos(c + d*x)/d + 5*b*x**4*sin(c + d*x)/d**2 + 20*b*x**3
*cos(c + d*x)/d**3 - 60*b*x**2*sin(c + d*x)/d**4 - 120*b*x*cos(c + d*x)/d*
*5 + 120*b*sin(c + d*x)/d**6, Ne(d, 0)), ((a*x**3/3 + b*x**6/6)*sin(c), Tr
ue))
```

### 3.80.7 Maxima [B] (verification not implemented)

Leaf count of result is larger than twice the leaf count of optimal. 326 vs. 2(126) = 252.

Time = 0.21 (sec) , antiderivative size = 326, normalized size of antiderivative = 2.59

$$\int x^2(a+bx^3)\sin(c+dx)\,dx =$$

$$-\frac{ac^2\cos(dx+c)-\frac{bc^5\cos(dx+c)}{d^3}-2\left((dx+c)\cos(dx+c)-\sin(dx+c)\right)ac+\frac{5\left((dx+c)\cos(dx+c)-\sin(dx+c)\right)bc^4}{d^3}}{}$$

input
```
integrate(x^2*(b*x^3+a)*sin(d*x+c),x, algorithm="maxima")
```

output
```
-(a*c^2*cos(d*x + c) - b*c^5*cos(d*x + c)/d^3 - 2*((d*x + c)*cos(d*x + c)
- sin(d*x + c))*a*c + 5*((d*x + c)*cos(d*x + c) - sin(d*x + c))*b*c^4/d^3
+ (((d*x + c)^2 - 2)*cos(d*x + c) - 2*(d*x + c)*sin(d*x + c))*a - 10*(((d*
x + c)^2 - 2)*cos(d*x + c) - 2*(d*x + c)*sin(d*x + c))*b*c^3/d^3 + 10*(((d
*x + c)^3 - 6*d*x - 6*c)*cos(d*x + c) - 3*((d*x + c)^2 - 2)*sin(d*x + c))*
b*c^2/d^3 - 5*(((d*x + c)^4 - 12*(d*x + c)^2 + 24)*cos(d*x + c) - 4*((d*x
+ c)^3 - 6*d*x - 6*c)*sin(d*x + c))*b*c/d^3 + (((d*x + c)^5 - 20*(d*x + c)
^3 + 120*d*x + 120*c)*cos(d*x + c) - 5*((d*x + c)^4 - 12*(d*x + c)^2 + 24)
*sin(d*x + c))*b/d^3)/d^3
```

### 3.80.8 Giac [A] (verification not implemented)

Time = 0.29 (sec) , antiderivative size = 88, normalized size of antiderivative = 0.70

$$\int x^2(a+bx^3)\sin(c+dx)\,dx = -\frac{(bd^5x^5+ad^5x^2-20\,bd^3x^3-2\,ad^3+120\,bdx)\cos(dx+c)}{d^6} + \frac{(5\,bd^4x^4+2\,ad^4x-60\,bd^2x^2+120\,b)\sin(dx+c)}{d^6}$$

input
```
integrate(x^2*(b*x^3+a)*sin(d*x+c),x, algorithm="giac")
```

output
```
-(b*d^5*x^5 + a*d^5*x^2 - 20*b*d^3*x^3 - 2*a*d^3 + 120*b*d*x)*cos(d*x + c)
/d^6 + (5*b*d^4*x^4 + 2*a*d^4*x - 60*b*d^2*x^2 + 120*b)*sin(d*x + c)/d^6
```

### 3.80.9 Mupad [B] (verification not implemented)

Time = 6.37 (sec) , antiderivative size = 121, normalized size of antiderivative = 0.96

$$\int x^2(a+bx^3)\sin(c+dx)\,dx$$
$$= \frac{120\,b\,\sin(c+d\,x)+d^4\,(5\,b\,x^4\,\sin(c+d\,x)+2\,a\,x\,\sin(c+d\,x))-d^5\,(a\,x^2\,\cos(c+d\,x)+b\,x^5\,\cos(c+d\,x}{d^6}$$

input
```
int(x^2*sin(c + d*x)*(a + b*x^3),x)
```

output
```
(120*b*sin(c + d*x) + d^4*(5*b*x^4*sin(c + d*x) + 2*a*x*sin(c + d*x)) - d^
5*(a*x^2*cos(c + d*x) + b*x^5*cos(c + d*x)) + d^3*(2*a*cos(c + d*x) + 20*b
*x^3*cos(c + d*x)) - 60*b*d^2*x^2*sin(c + d*x) - 120*b*d*x*cos(c + d*x))/d
^6
```

# 3.81 $\int x(a+bx^3)\sin(c+dx)\,dx$



## 3.81.1 Optimal result

Integrand size = 15, antiderivative size = 95

$$\int x(a+bx^3)\sin(c+dx)\,dx = -\frac{24b\cos(c+dx)}{d^5}-\frac{ax\cos(c+dx)}{d}+\frac{12bx^2\cos(c+dx)}{d^3}-\frac{bx^4\cos(c+dx)}{d}+\frac{a\sin(c+dx)}{d^2}-\frac{24bx\sin(c+dx)}{d^4}+\frac{4bx^3\sin(c+dx)}{d^2}$$

output
```
-24*b*cos(d*x+c)/d^5-a*x*cos(d*x+c)/d+12*b*x^2*cos(d*x+c)/d^3-b*x^4*cos(d*
x+c)/d+a*sin(d*x+c)/d^2-24*b*x*sin(d*x+c)/d^4+4*b*x^3*sin(d*x+c)/d^2
```

## 3.81.2 Mathematica [A] (verified)

Time = 0.07 (sec) , antiderivative size = 66, normalized size of antiderivative = 0.69

$$\int x(a+bx^3)\sin(c+dx)\,dx = \frac{-((ad^4x+b(24-12d^2x^2+d^4x^4))\cos(c+dx))+d(ad^2+4bx(-6+d^2x^2))\sin(c+dx)}{d^5}$$

input
```
Integrate[x*(a + b*x^3)*Sin[c + d*x],x]
```

output
```
(-((a*d^4*x + b*(24 - 12*d^2*x^2 + d^4*x^4))*Cos[c + d*x]) + d*(a*d^2 + 4*
b*x*(-6 + d^2*x^2))*Sin[c + d*x])/d^5
```

### 3.81.3 Rubi [A] (verified)

Time = 0.31 (sec) , antiderivative size = 95, normalized size of antiderivative = 1.00, number of steps used = 2, number of rules used = 2, $\frac{\text{number of rules}}{\text{integrand size}} = 0.133$, Rules used = {3820, 2009}

Below are the steps used by Rubi to obtain the solution. The rule number used for the transformation is given above next to the arrow. The rules definitions used are listed below.

$$\int x\left(a+bx^3\right)\sin(c+dx)\,dx$$

$$\Big\downarrow \text{3820}$$

$$\int \left(ax\sin(c+dx)+bx^4\sin(c+dx)\right)dx$$

$$\Big\downarrow \text{2009}$$

$$\frac{a\sin(c+dx)}{d^2}-\frac{ax\cos(c+dx)}{d}-\frac{24b\cos(c+dx)}{d^5}-\frac{24bx\sin(c+dx)}{d^4}+\frac{12bx^2\cos(c+dx)}{d^3}+\frac{4bx^3\sin(c+dx)}{d^2}-\frac{bx^4\cos(c+dx)}{d}$$

input
```
Int[x*(a + b*x^3)*Sin[c + d*x],x]
```

output
```
(-24*b*Cos[c + d*x])/d^5 - (a*x*Cos[c + d*x])/d + (12*b*x^2*Cos[c + d*x])/
d^3 - (b*x^4*Cos[c + d*x])/d + (a*Sin[c + d*x])/d^2 - (24*b*x*Sin[c + d*x]
)/d^4 + (4*b*x^3*Sin[c + d*x])/d^2
```

#### 3.81.3.1 Defintions of rubi rules used

rule 2009
```
Int[u_, x_Symbol] :> Simp[IntSum[u, x], x] /; SumQ[u]
```

rule 3820
```
Int[((e_.)*(x_))^(m_.)*((a_) + (b_.)*(x_)^(n_))^(p_.)*Sin[(c_.) + (d_.)*(x_
)], x_Symbol] :> Int[ExpandIntegrand[Sin[c + d*x], (e*x)^m*(a + b*x^n)^p, x
], x] /; FreeQ[{a, b, c, d, e, m, n}, x] && IGtQ[p, 0]
```

### 3.81.4 Maple [A] (verified)

Time = 0.14 (sec) , antiderivative size = 69, normalized size of antiderivative = 0.73

| method | result |
|---|---|
| risch | $-\frac{(b\,x^4 d^4+a\,d^4 x-12d^2 x^2 b+24b)\cos(dx+c)}{d^5}+\frac{(4b\,d^2 x^3+a\,d^2-24bx)\sin(dx+c)}{d^4}$ |
| parallelrisch | $\frac{((b\,x^3+a)d^2-12bx)x\,d^2\left(\tan^2\left(\frac{dx}{2}+\frac{c}{2}\right)\right)+2((4b\,x^3+a)d^2-24bx)d\tan\left(\frac{dx}{2}+\frac{c}{2}\right)+(-b\,x^4-ax)d^4+12d^2x^2b-48b}{d^5\left(1+\tan^2\left(\frac{dx}{2}+\frac{c}{2}\right)\right)}$ |
| norman | $\frac{\frac{ax\left(\tan^2\left(\frac{dx}{2}+\frac{c}{2}\right)\right)}{d}+\frac{b\,x^4\left(\tan^2\left(\frac{dx}{2}+\frac{c}{2}\right)\right)}{d}-\frac{48b}{d^5}+\frac{2a\tan\left(\frac{dx}{2}+\frac{c}{2}\right)}{d^2}-\frac{ax}{d}+\frac{12b\,x^2}{d^3}-\frac{b\,x^4}{d}-\frac{48bx\tan\left(\frac{dx}{2}+\frac{c}{2}\right)}{d^4}-\frac{12b\,x^2\left(\tan^2\left(\frac{dx}{2}+\frac{c}{2}\right)\right.}{d^3}}{1+\tan^2\left(\frac{dx}{2}+\frac{c}{2}\right)}$ |
| parts | $-\frac{b\,x^4\cos(dx+c)}{d}-\frac{ax\cos(dx+c)}{d}+\frac{a\sin(dx+c)-\frac{4b\,c^3\sin(dx+c)}{d^3}+\frac{12b\,c^2(\cos(dx+c)+(dx+c)\sin(dx+c))}{d^3}-\frac{12bc\left((dx+c)^2\right.}{}}{}$ |
| meijerg | $\frac{16b\sqrt{\pi}\,\sin(c)\left(-\frac{x\left(d^2\right)^{\frac{5}{2}}\left(-\frac{5d^2x^2}{2}+15\right)\cos(dx)}{10\sqrt{\pi}\,d^4}+\frac{\left(d^2\right)^{\frac{5}{2}}\left(\frac{5}{8}d^4x^4-\frac{15}{2}d^2x^2+15\right)\sin(dx)}{10\sqrt{\pi}\,d^5}\right)}{d^4\sqrt{d^2}}+\frac{16b\sqrt{\pi}\,\cos(c)\left(\frac{3}{2\sqrt{\pi}}-\frac{\left(\frac{3}{8}d^4x^4\right.}{}\right.}{}$ |
| derivativedivides | $\frac{ac\cos(dx+c)+a(\sin(dx+c)-\cos(dx+c)(dx+c))-\frac{b\,c^4\cos(dx+c)}{d^3}-\frac{4b\,c^3(\sin(dx+c)-\cos(dx+c)(dx+c))}{d^3}+\frac{6b\,c^2\left(-(dx+c)^2\cos(d\right.}{}}{}$ |
| default | $\frac{ac\cos(dx+c)+a(\sin(dx+c)-\cos(dx+c)(dx+c))-\frac{b\,c^4\cos(dx+c)}{d^3}-\frac{4b\,c^3(\sin(dx+c)-\cos(dx+c)(dx+c))}{d^3}+\frac{6b\,c^2\left(-(dx+c)^2\cos(d\right.}{}}{}$ |

input
```
int(x*(b*x^3+a)*sin(d*x+c),x,method=_RETURNVERBOSE)
```

output
```
-(b*d^4*x^4+a*d^4*x-12*b*d^2*x^2+24*b)/d^5*cos(d*x+c)+1/d^4*(4*b*d^2*x^3+a
*d^2-24*b*x)*sin(d*x+c)
```

### 3.81.5 Fricas [A] (verification not implemented)

Time = 0.26 (sec) , antiderivative size = 68, normalized size of antiderivative = 0.72

$$\int x(a+bx^3)\sin(c+dx)\,dx$$
$$=-\frac{(bd^4x^4+ad^4x-12\,bd^2x^2+24\,b)\cos(dx+c)-(4\,bd^3x^3+ad^3-24\,bdx)\sin(dx+c)}{d^5}$$

input
```
integrate(x*(b*x^3+a)*sin(d*x+c),x, algorithm="fricas")
```

output
```
-((b*d^4*x^4 + a*d^4*x - 12*b*d^2*x^2 + 24*b)*cos(d*x + c) - (4*b*d^3*x^3
+ a*d^3 - 24*b*d*x)*sin(d*x + c))/d^5
```

### 3.81.6 Sympy [A] (verification not implemented)

Time = 0.32 (sec) , antiderivative size = 116, normalized size of antiderivative = 1.22

$$\int x(a+bx^3)\sin(c+dx)\,dx$$
$$= \begin{cases} -\frac{ax\cos(c+dx)}{d} + \frac{a\sin(c+dx)}{d^2} - \frac{bx^4\cos(c+dx)}{d} + \frac{4bx^3\sin(c+dx)}{d^2} + \frac{12bx^2\cos(c+dx)}{d^3} - \frac{24bx\sin(c+dx)}{d^4} - \frac{24b\cos(c+dx)}{d^5} & \text{for} \\ \left(\frac{ax^2}{2} + \frac{bx^5}{5}\right)\sin(c) & \text{oth} \end{cases}$$

input
```
integrate(x*(b*x**3+a)*sin(d*x+c),x)
```

output
```
Piecewise((-a*x*cos(c + d*x)/d + a*sin(c + d*x)/d**2 - b*x**4*cos(c + d*x)
/d + 4*b*x**3*sin(c + d*x)/d**2 + 12*b*x**2*cos(c + d*x)/d**3 - 24*b*x*sin
(c + d*x)/d**4 - 24*b*cos(c + d*x)/d**5, Ne(d, 0)), ((a*x**2/2 + b*x**5/5)
*sin(c), True))
```

### 3.81.7 Maxima [B] (verification not implemented)

Leaf count of result is larger than twice the leaf count of optimal. 224 vs. 2(95) = 190.

Time = 0.19 (sec) , antiderivative size = 224, normalized size of antiderivative = 2.36

$$\int x(a+bx^3)\sin(c+dx)\,dx$$
$$= \frac{ac\cos(dx+c) - \frac{bc^4\cos(dx+c)}{d^3} - ((dx+c)\cos(dx+c) - \sin(dx+c))a + \frac{4((dx+c)\cos(dx+c)-\sin(dx+c))bc^3}{d^3} - \frac{6(\cdots}{}}{}$$

input
```
integrate(x*(b*x^3+a)*sin(d*x+c),x, algorithm="maxima")
```

output
```
(a*c*cos(d*x + c) - b*c^4*cos(d*x + c)/d^3 - ((d*x + c)*cos(d*x + c) - sin
(d*x + c))*a + 4*((d*x + c)*cos(d*x + c) - sin(d*x + c))*b*c^3/d^3 - 6*(((
d*x + c)^2 - 2)*cos(d*x + c) - 2*(d*x + c)*sin(d*x + c))*b*c^2/d^3 + 4*(((
d*x + c)^3 - 6*d*x - 6*c)*cos(d*x + c) - 3*((d*x + c)^2 - 2)*sin(d*x + c))
*b*c/d^3 - (((d*x + c)^4 - 12*(d*x + c)^2 + 24)*cos(d*x + c) - 4*((d*x + c
)^3 - 6*d*x - 6*c)*sin(d*x + c))*b/d^3)/d^2
```

### 3.81.8 Giac [A] (verification not implemented)

Time = 0.31 (sec) , antiderivative size = 69, normalized size of antiderivative = 0.73

$$\int x(a+bx^3)\sin(c+dx)\,dx = -\frac{(bd^4x^4+ad^4x-12\,bd^2x^2+24\,b)\cos(dx+c)}{d^5} + \frac{(4\,bd^3x^3+ad^3-24\,bdx)\sin(dx+c)}{d^5}$$

input
```
integrate(x*(b*x^3+a)*sin(d*x+c),x, algorithm="giac")
```

output
```
-(b*d^4*x^4 + a*d^4*x - 12*b*d^2*x^2 + 24*b)*cos(d*x + c)/d^5 + (4*b*d^3*x
^3 + a*d^3 - 24*b*d*x)*sin(d*x + c)/d^5
```

### 3.81.9 Mupad [B] (verification not implemented)

Time = 6.11 (sec) , antiderivative size = 92, normalized size of antiderivative = 0.97

$$\int x(a+bx^3)\sin(c+dx)\,dx = -\frac{d^4\left(a\,x\,\cos(c+d\,x)+b\,x^4\,\cos(c+d\,x)\right)+24\,b\,\cos(c+d\,x)-d^3\left(a\,\sin(c+d\,x)+4\,b\,x^3\,\sin(c+d\,x)\right)}{d^5}$$

input
```
int(x*sin(c + d*x)*(a + b*x^3),x)
```

output
```
-(d^4*(a*x*cos(c + d*x) + b*x^4*cos(c + d*x)) + 24*b*cos(c + d*x) - d^3*(a
*sin(c + d*x) + 4*b*x^3*sin(c + d*x)) + 24*b*d*x*sin(c + d*x) - 12*b*d^2*x
^2*cos(c + d*x))/d^5
```

# 3.82 $\int (a+bx^3)\sin(c+dx)\,dx$



## 3.82.1 Optimal result

Integrand size = 14, antiderivative size = 68

$$\int (a+bx^3)\sin(c+dx)\,dx = -\frac{a\cos(c+dx)}{d}+\frac{6bx\cos(c+dx)}{d^3}-\frac{bx^3\cos(c+dx)}{d}-\frac{6b\sin(c+dx)}{d^4}+\frac{3bx^2\sin(c+dx)}{d^2}$$

output
```
-a*cos(d*x+c)/d+6*b*x*cos(d*x+c)/d^3-b*x^3*cos(d*x+c)/d-6*b*sin(d*x+c)/d^4
+3*b*x^2*sin(d*x+c)/d^2
```

## 3.82.2 Mathematica [A] (verified)

Time = 0.05 (sec) , antiderivative size = 50, normalized size of antiderivative = 0.74

$$\int (a+bx^3)\sin(c+dx)\,dx = \frac{-d(ad^2+bx(-6+d^2x^2))\cos(c+dx)+3b(-2+d^2x^2)\sin(c+dx)}{d^4}$$

input
```
Integrate[(a + b*x^3)*Sin[c + d*x],x]
```

output
```
(-(d*(a*d^2 + b*x*(-6 + d^2*x^2))*Cos[c + d*x]) + 3*b*(-2 + d^2*x^2)*Sin[c
 + d*x])/d^4
```

### 3.82.3 Rubi [A] (verified)

Time = 0.25 (sec) , antiderivative size = 68, normalized size of antiderivative = 1.00, number of steps used = 2, number of rules used = 2, $\frac{\text{number of rules}}{\text{integrand size}}$ = 0.143, Rules used = {3810, 2009}

Below are the steps used by Rubi to obtain the solution. The rule number used for the transformation is given above next to the arrow. The rules definitions used are listed below.

$$\int \left(a+bx^3\right)\sin(c+dx)\,dx$$

$$\Big\downarrow \ 3810$$

$$\int \left(a\sin(c+dx)+bx^3\sin(c+dx)\right)dx$$

$$\Big\downarrow \ 2009$$

$$-\frac{a\cos(c+dx)}{d}-\frac{6b\sin(c+dx)}{d^4}+\frac{6bx\cos(c+dx)}{d^3}+\frac{3bx^2\sin(c+dx)}{d^2}-\frac{bx^3\cos(c+dx)}{d}$$

input
```
Int[(a + b*x^3)*Sin[c + d*x],x]
```

output
```
-((a*Cos[c + d*x])/d) + (6*b*x*Cos[c + d*x])/d^3 - (b*x^3*Cos[c + d*x])/d
- (6*b*Sin[c + d*x])/d^4 + (3*b*x^2*Sin[c + d*x])/d^2
```

#### 3.82.3.1 Defintions of rubi rules used

rule 2009
```
Int[u_, x_Symbol] :> Simp[IntSum[u, x], x] /; SumQ[u]
```

rule 3810
```
Int[((a_) + (b_.)*(x_)^(n_))^(p_.)*Sin[(c_.) + (d_.)*(x_)], x_Symbol] :> In
t[ExpandIntegrand[Sin[c + d*x], (a + b*x^n)^p, x], x] /; FreeQ[{a, b, c, d,
 n}, x] && IGtQ[p, 0]
```

## 3.82.4 Maple [A] (verified)

Time = 0.14 (sec) , antiderivative size = 52, normalized size of antiderivative = 0.76

| method | result |
|---|---|
| risch | $-\frac{(b\,d^2x^3+a\,d^2-6bx)\cos(dx+c)}{d^3}+\frac{3b(d^2x^2-2)\sin(dx+c)}{d^4}$ |
| parallelrisch | $\frac{dxb(d^2x^2-6)\left(\tan^2\left(\frac{dx}{2}+\frac{c}{2}\right)\right)+6b(d^2x^2-2)\tan\left(\frac{dx}{2}+\frac{c}{2}\right)+(-b\,x^3-2a)\,d^3+6dxb}{d^4\left(1+\tan^2\left(\frac{dx}{2}+\frac{c}{2}\right)\right)}$ |
| parts | $-\frac{b\,x^3\cos(dx+c)}{d}-\frac{a\cos(dx+c)}{d}+\frac{3b\left(c^2\sin(dx+c)-2c(\cos(dx+c)+(dx+c)\sin(dx+c))+(dx+c)^2\sin(dx+c)-2\sin(\right.}{d^4}$ |
| norman | $\frac{\frac{2a\left(\tan^2\left(\frac{dx}{2}+\frac{c}{2}\right)\right)}{d}+\frac{b\,x^3\left(\tan^2\left(\frac{dx}{2}+\frac{c}{2}\right)\right)}{d}-\frac{12b\tan\left(\frac{dx}{2}+\frac{c}{2}\right)}{d^4}+\frac{6bx}{d^3}-\frac{b\,x^3}{d}-\frac{6bx\left(\tan^2\left(\frac{dx}{2}+\frac{c}{2}\right)\right)}{d^3}+\frac{6b\,x^2\tan\left(\frac{dx}{2}+\frac{c}{2}\right)}{d^2}}{1+\tan^2\left(\frac{dx}{2}+\frac{c}{2}\right)}$ |
| meijerg | $\frac{8b\sqrt{\pi}\,\sin(c)\left(\frac{3}{4\sqrt{\pi}}-\frac{\left(-\frac{3d^2x^2}{2}+3\right)\cos(dx)}{4\sqrt{\pi}}-\frac{dx\left(-\frac{d^2x^2}{2}+3\right)\sin(dx)}{4\sqrt{\pi}}\right)}{d^4}+\frac{8b\sqrt{\pi}\,\cos(c)\left(\frac{xd\left(-\frac{5d^2x^2}{2}+15\right)\cos(dx)}{20\sqrt{\pi}}-\frac{\left(-\frac{15d}{}\right.}{}\right.}{d^4}$ |
| derivativedivides | $\frac{-\cos(dx+c)a+\frac{b\,c^3\cos(dx+c)}{d^3}+\frac{3b\,c^2(\sin(dx+c)-\cos(dx+c)(dx+c))}{d^3}-\frac{3bc\left(-(dx+c)^2\cos(dx+c)+2\cos(dx+c)+2(dx+c)\sin(dx+c)\right)}{d^3}}{d}$ |
| default | $\frac{-\cos(dx+c)a+\frac{b\,c^3\cos(dx+c)}{d^3}+\frac{3b\,c^2(\sin(dx+c)-\cos(dx+c)(dx+c))}{d^3}-\frac{3bc\left(-(dx+c)^2\cos(dx+c)+2\cos(dx+c)+2(dx+c)\sin(dx+c)\right)}{d^3}}{d}$ |

input
```
int((b*x^3+a)*sin(d*x+c),x,method=_RETURNVERBOSE)
```

output
```
-1/d^3*(b*d^2*x^3+a*d^2-6*b*x)*cos(d*x+c)+3*b*(d^2*x^2-2)/d^4*sin(d*x+c)
```

## 3.82.5 Fricas [A] (verification not implemented)

Time = 0.26 (sec) , antiderivative size = 52, normalized size of antiderivative = 0.76

$$\int (a+bx^3)\sin(c+dx)\,dx=-\frac{(bd^3x^3+ad^3-6\,bdx)\cos(dx+c)-3\,(bd^2x^2-2\,b)\sin(dx+c)}{d^4}$$

input
```
integrate((b*x^3+a)*sin(d*x+c),x, algorithm="fricas")
```

output
```
-((b*d^3*x^3 + a*d^3 - 6*b*d*x)*cos(d*x + c) - 3*(b*d^2*x^2 - 2*b)*sin(d*x
 + c))/d^4
```

### 3.82.6 Sympy [A] (verification not implemented)

Time = 0.24 (sec) , antiderivative size = 82, normalized size of antiderivative = 1.21

$$\int (a+bx^3)\sin(c+dx)\,dx$$
$$= \begin{cases} -\frac{a\cos(c+dx)}{d} - \frac{bx^3\cos(c+dx)}{d} + \frac{3bx^2\sin(c+dx)}{d^2} + \frac{6bx\cos(c+dx)}{d^3} - \frac{6b\sin(c+dx)}{d^4} & \text{for } d \neq 0 \\ \left(ax + \frac{bx^4}{4}\right)\sin(c) & \text{otherwise} \end{cases}$$

input
```
integrate((b*x**3+a)*sin(d*x+c),x)
```

output
```
Piecewise((-a*cos(c + d*x)/d - b*x**3*cos(c + d*x)/d + 3*b*x**2*sin(c + d*
x)/d**2 + 6*b*x*cos(c + d*x)/d**3 - 6*b*sin(c + d*x)/d**4, Ne(d, 0)), ((a*
x + b*x**4/4)*sin(c), True))
```

### 3.82.7 Maxima [B] (verification not implemented)

Leaf count of result is larger than twice the leaf count of optimal. 141 vs. 2(68) = 136.

Time = 0.19 (sec) , antiderivative size = 141, normalized size of antiderivative = 2.07

$$\int (a+bx^3)\sin(c+dx)\,dx =$$
$$-\frac{a\cos(dx+c) - \frac{bc^3\cos(dx+c)}{d^3} + \frac{3((dx+c)\cos(dx+c)-\sin(dx+c))bc^2}{d^3} - \frac{3\left(\left((dx+c)^2-2\right)\cos(dx+c)-2(dx+c)\sin(dx+c)\right)bc}{d^3} + \left(\cdots\right.}{d}$$

input
```
integrate((b*x^3+a)*sin(d*x+c),x, algorithm="maxima")
```

output
```
-(a*cos(d*x + c) - b*c^3*cos(d*x + c)/d^3 + 3*((d*x + c)*cos(d*x + c) - si
n(d*x + c))*b*c^2/d^3 - 3*(((d*x + c)^2 - 2)*cos(d*x + c) - 2*(d*x + c)*si
n(d*x + c))*b*c/d^3 + (((d*x + c)^3 - 6*d*x - 6*c)*cos(d*x + c) - 3*((d*x
+ c)^2 - 2)*sin(d*x + c))*b/d^3)/d
```

### 3.82.8 Giac [A] (verification not implemented)

Time = 0.29 (sec) , antiderivative size = 54, normalized size of antiderivative = 0.79

$$\int (a+bx^3)\sin(c+dx)\,dx = -\frac{(bd^3x^3+ad^3-6\,bdx)\cos(dx+c)}{d^4}+\frac{3\,(bd^2x^2-2\,b)\sin(dx+c)}{d^4}$$

input
```
integrate((b*x^3+a)*sin(d*x+c),x, algorithm="giac")
```

output
```
-(b*d^3*x^3 + a*d^3 - 6*b*d*x)*cos(d*x + c)/d^4 + 3*(b*d^2*x^2 - 2*b)*sin(
d*x + c)/d^4
```

### 3.82.9 Mupad [B] (verification not implemented)

Time = 0.13 (sec) , antiderivative size = 65, normalized size of antiderivative = 0.96

$$\int (a+bx^3)\sin(c+dx)\,dx = -\frac{6\,b\,\sin(c+d\,x)+d^3\,(a\,\cos(c+d\,x)+b\,x^3\,\cos(c+d\,x))-3\,b\,d^2\,x^2\,\sin(c+d\,x)-6\,b\,d\,x\,\cos(c+d\,x)}{d^4}$$

input
```
int(sin(c + d*x)*(a + b*x^3),x)
```

output
```
-(6*b*sin(c + d*x) + d^3*(a*cos(c + d*x) + b*x^3*cos(c + d*x)) - 3*b*d^2*x
^2*sin(c + d*x) - 6*b*d*x*cos(c + d*x))/d^4
```

# 3.83 $\int \frac{(a+bx^3)\sin(c+dx)}{x}\,dx$



## 3.83.1 Optimal result

Integrand size = 17, antiderivative size = 57

$$\int \frac{(a+bx^3)\sin(c+dx)}{x}\,dx = \frac{2b\cos(c+dx)}{d^3} - \frac{bx^2\cos(c+dx)}{d} + a\,\text{CosIntegral}(dx)\sin(c) + \frac{2bx\sin(c+dx)}{d^2} + a\cos(c)\text{Si}(dx)$$

output
```
2*b*cos(d*x+c)/d^3-b*x^2*cos(d*x+c)/d+a*cos(c)*Si(d*x)+a*Ci(d*x)*sin(c)+2*
b*x*sin(d*x+c)/d^2
```

## 3.83.2 Mathematica [A] (verified)

Time = 0.12 (sec) , antiderivative size = 50, normalized size of antiderivative = 0.88

$$\int \frac{(a+bx^3)\sin(c+dx)}{x}\,dx = a\,\text{CosIntegral}(dx)\sin(c) + \frac{b((2-d^2x^2)\cos(c+dx)+2dx\sin(c+dx))}{d^3} + a\cos(c)\text{Si}(dx)$$

input
```
Integrate[((a + b*x^3)*Sin[c + d*x])/x,x]
```

output
```
a*CosIntegral[d*x]*Sin[c] + (b*((2 - d^2*x^2)*Cos[c + d*x] + 2*d*x*Sin[c +
 d*x]))/d^3 + a*Cos[c]*SinIntegral[d*x]
```

## 3.83.3 Rubi [A] (verified)

Time = 0.28 (sec) , antiderivative size = 57, normalized size of antiderivative = 1.00, number of steps used = 2, number of rules used = 2, $\frac{\text{number of rules}}{\text{integrand size}}$ = 0.118, Rules used = {3820, 2009}

Below are the steps used by Rubi to obtain the solution. The rule number used for the transformation is given above next to the arrow. The rules definitions used are listed below.

$$\int \frac{(a+bx^3)\sin(c+dx)}{x}\,dx$$

$$\Big\downarrow \; 3820$$

$$\int \left(\frac{a\sin(c+dx)}{x}+bx^2\sin(c+dx)\right)dx$$

$$\Big\downarrow \; 2009$$

$$a\sin(c)\,\text{CosIntegral}(dx)+a\cos(c)\text{Si}(dx)+\frac{2b\cos(c+dx)}{d^3}+\frac{2bx\sin(c+dx)}{d^2}-\frac{bx^2\cos(c+dx)}{d}$$

input
```
Int[((a + b*x^3)*Sin[c + d*x])/x,x]
```

output
```
(2*b*Cos[c + d*x])/d^3 - (b*x^2*Cos[c + d*x])/d + a*CosIntegral[d*x]*Sin[c
] + (2*b*x*Sin[c + d*x])/d^2 + a*Cos[c]*SinIntegral[d*x]
```

### 3.83.3.1 Defintions of rubi rules used

rule 2009
```
Int[u_, x_Symbol] :> Simp[IntSum[u, x], x] /; SumQ[u]
```

rule 3820
```
Int[((e_.)*(x_))^(m_.)*((a_) + (b_.)*(x_)^(n_))^(p_.)*Sin[(c_.) + (d_.)*(x_
)], x_Symbol] :> Int[ExpandIntegrand[Sin[c + d*x], (e*x)^m*(a + b*x^n)^p, x
], x] /; FreeQ[{a, b, c, d, e, m, n}, x] && IGtQ[p, 0]
```

## 3.83.4 Maple [C] (warning: unable to verify)

Result contains higher order function than in optimal. Order 9 vs. order 4.

Time = 0.18 (sec) , antiderivative size = 98, normalized size of antiderivative = 1.72

| method | result |
|---|---|
| risch | $-\frac{e^{-ic}\pi \operatorname{csgn}(dx)a}{2}-\frac{ie^{-ic}\operatorname{Ei}_1(-idx)a}{2}+\frac{ia\,e^{ic}\operatorname{Ei}_1(-idx)}{2}-\frac{b\,x^2\cos(dx+c)}{d}+e^{-ic}\operatorname{Si}(dx)\,a+\frac{2bx\sin(dx+}{d^2}$ |
| derivativedivides | $a(\operatorname{Si}(dx)\cos(c)+\operatorname{Ci}(dx)\sin(c))-\frac{3b\,c^2\cos(dx+c)}{d^3}-\frac{3bc(c+1)(\sin(dx+c)-\cos(dx+c)(dx+c))}{d^3}+\frac{(c^2}{}$ |
| default | $a(\operatorname{Si}(dx)\cos(c)+\operatorname{Ci}(dx)\sin(c))-\frac{3b\,c^2\cos(dx+c)}{d^3}-\frac{3bc(c+1)(\sin(dx+c)-\cos(dx+c)(dx+c))}{d^3}+\frac{(c^2}{}$ |
| meijerg | $\frac{4b\sqrt{\pi}\,\sin(c)\left(\frac{x\left(d^2\right)^{\frac{3}{2}}\cos(dx)}{2\sqrt{\pi}\,d^2}-\frac{\left(d^2\right)^{\frac{3}{2}}\left(-\frac{3d^2x^2}{2}+3\right)\sin(dx)}{6\sqrt{\pi}\,d^3}\right)}{d^2\sqrt{d^2}}+\frac{4b\sqrt{\pi}\,\cos(c)\left(-\frac{1}{2\sqrt{\pi}}+\frac{\left(-\frac{d^2x^2}{2}+1\right)\cos(dx)}{2\sqrt{\pi}}+\frac{dx\sin(dx)}{2\sqrt{\pi}}\right.}{d^3}$ |

input
```
int((b*x^3+a)*sin(d*x+c)/x,x,method=_RETURNVERBOSE)
```

output
```
-1/2*exp(-I*c)*Pi*csgn(d*x)*a-1/2*I*exp(-I*c)*Ei(1,-I*d*x)*a+1/2*I*a*exp(I
*c)*Ei(1,-I*d*x)-b*x^2*cos(d*x+c)/d+exp(-I*c)*Si(d*x)*a+2*b*x*sin(d*x+c)/d
^2+2*b*cos(d*x+c)/d^3
```

## 3.83.5 Fricas [A] (verification not implemented)

Time = 0.28 (sec) , antiderivative size = 58, normalized size of antiderivative = 1.02

$$\int \frac{(a+bx^3)\sin(c+dx)}{x}\,dx = \frac{ad^3\operatorname{Ci}(dx)\sin(c)+ad^3\cos(c)\operatorname{Si}(dx)+2\,bdx\sin(dx+c)-(bd^2x^2-2\,b)\cos(dx+c)}{d^3}$$

input
```
integrate((b*x^3+a)*sin(d*x+c)/x,x, algorithm="fricas")
```

output
```
(a*d^3*cos_integral(d*x)*sin(c) + a*d^3*cos(c)*sin_integral(d*x) + 2*b*d*x
*sin(d*x + c) - (b*d^2*x^2 - 2*b)*cos(d*x + c))/d^3
```

### 3.83.6 Sympy [A] (verification not implemented)

Time = 2.75 (sec) , antiderivative size = 83, normalized size of antiderivative = 1.46

$$\int \frac{(a+bx^3)\sin(c+dx)}{x}\,dx = a\sin(c)\,\mathrm{Ci}\,(dx) + a\cos(c)\,\mathrm{Si}\,(dx) + bx^2\left(\begin{cases} x\sin(c) & \text{for } d=0 \\ -\frac{\cos(c+dx)}{d} & \text{otherwise}\end{cases}\right) - 2b\left(\begin{cases} \frac{x^3\sin(c)}{3} & \text{for } d=0 \\ -\frac{\begin{cases}\frac{x\sin(c+dx)}{d} + \frac{\cos(c+dx)}{d^2} & \text{for } d\neq 0 \\ \frac{x^2\cos(c)}{2} & \text{otherwise}\end{cases}}{d} & \text{otherwise}\end{cases}\right)$$

input
```
integrate((b*x**3+a)*sin(d*x+c)/x,x)
```

output
```
a*sin(c)*Ci(d*x) + a*cos(c)*Si(d*x) + b*x**2*Piecewise((x*sin(c), Eq(d, 0)
), (-cos(c + d*x)/d, True)) - 2*b*Piecewise((x**3*sin(c)/3, Eq(d, 0)), (-P
iecewise((x*sin(c + d*x)/d + cos(c + d*x)/d**2, Ne(d, 0)), (x**2*cos(c)/2,
 True))/d, True))
```

### 3.83.7 Maxima [C] (verification not implemented)

Result contains complex when optimal does not.

Time = 0.58 (sec) , antiderivative size = 76, normalized size of antiderivative = 1.33

$$\int \frac{(a+bx^3)\sin(c+dx)}{x}\,dx = \frac{(a(-i\,\mathrm{Ei}(i\,dx) + i\,\mathrm{Ei}(-i\,dx))\cos(c) + a(\mathrm{Ei}(i\,dx) + \mathrm{Ei}(-i\,dx))\sin(c))d^3 + 4\,bdx\sin(dx+c) - 2\,(bd^2x^2 -}{2\,d^3}$$

input
```
integrate((b*x^3+a)*sin(d*x+c)/x,x, algorithm="maxima")
```

output
```
1/2*((a*(-I*Ei(I*d*x) + I*Ei(-I*d*x))*cos(c) + a*(Ei(I*d*x) + Ei(-I*d*x))*
sin(c))*d^3 + 4*b*d*x*sin(d*x + c) - 2*(b*d^2*x^2 - 2*b)*cos(d*x + c))/d^3
```

### 3.83.8 Giac [C] (verification not implemented)

Result contains higher order function than in optimal. Order 9 vs. order 4.

Time = 0.32 (sec) , antiderivative size = 510, normalized size of antiderivative = 8.95

$$\int \frac{(a+bx^3)\sin(c+dx)}{x}\,dx = -\frac{2\,bd^2x^2\tan\left(\frac{1}{2}\,dx\right)^2\tan\left(\frac{1}{2}\,c\right)^2 + ad^3\Im(\mathrm{Ci}\,(dx))\tan\left(\frac{1}{2}\,dx\right)^2\tan\left(\frac{1}{2}\,c\right)^2 - ad^3\Im(\mathrm{Ci}\,(-dx))\tan\left(\frac{1}{2}\,dx\right)^2\tan}{}$$

input
```
integrate((b*x^3+a)*sin(d*x+c)/x,x, algorithm="giac")
```

output
```
-1/2*(2*b*d^2*x^2*tan(1/2*d*x)^2*tan(1/2*c)^2 + a*d^3*imag_part(cos_integr
al(d*x))*tan(1/2*d*x)^2*tan(1/2*c)^2 - a*d^3*imag_part(cos_integral(-d*x))
*tan(1/2*d*x)^2*tan(1/2*c)^2 + 2*a*d^3*sin_integral(d*x)*tan(1/2*d*x)^2*ta
n(1/2*c)^2 - 2*a*d^3*real_part(cos_integral(d*x))*tan(1/2*d*x)^2*tan(1/2*c
) - 2*a*d^3*real_part(cos_integral(-d*x))*tan(1/2*d*x)^2*tan(1/2*c) - 2*b*
d^2*x^2*tan(1/2*d*x)^2 - a*d^3*imag_part(cos_integral(d*x))*tan(1/2*d*x)^2
 + a*d^3*imag_part(cos_integral(-d*x))*tan(1/2*d*x)^2 - 2*a*d^3*sin_integr
al(d*x)*tan(1/2*d*x)^2 - 8*b*d^2*x^2*tan(1/2*d*x)*tan(1/2*c) - 2*b*d^2*x^2
*tan(1/2*c)^2 + a*d^3*imag_part(cos_integral(d*x))*tan(1/2*c)^2 - a*d^3*im
ag_part(cos_integral(-d*x))*tan(1/2*c)^2 + 2*a*d^3*sin_integral(d*x)*tan(1
/2*c)^2 - 2*a*d^3*real_part(cos_integral(d*x))*tan(1/2*c) - 2*a*d^3*real_p
art(cos_integral(-d*x))*tan(1/2*c) + 8*b*d*x*tan(1/2*d*x)^2*tan(1/2*c) + 8
*b*d*x*tan(1/2*d*x)*tan(1/2*c)^2 + 2*b*d^2*x^2 - a*d^3*imag_part(cos_integ
ral(d*x)) + a*d^3*imag_part(cos_integral(-d*x)) - 2*a*d^3*sin_integral(d*x
) - 4*b*tan(1/2*d*x)^2*tan(1/2*c)^2 - 8*b*d*x*tan(1/2*d*x) - 8*b*d*x*tan(1
/2*c) + 4*b*tan(1/2*d*x)^2 + 16*b*tan(1/2*d*x)*tan(1/2*c) + 4*b*tan(1/2*c)
^2 - 4*b)/(d^3*tan(1/2*d*x)^2*tan(1/2*c)^2 + d^3*tan(1/2*d*x)^2 + d^3*tan(
1/2*c)^2 + d^3)
```

### 3.83.9 Mupad [F(-1)]

Timed out.

$$\int \frac{(a+bx^3)\sin(c+dx)}{x}\,dx = a\,\mathrm{cosint}(d\,x)\,\sin(c) + a\,\mathrm{sinint}(d\,x)\,\cos(c) + \frac{b\,(2\,\cos(c+d\,x) - d^2\,x^2\,\cos(c+d\,x) + 2\,d\,x\,\sin(c+d\,x))}{d^3}$$

input
```
int((sin(c + d*x)*(a + b*x^3))/x,x)
```

output
```
a*cosint(d*x)*sin(c) + a*sinint(d*x)*cos(c) + (b*(2*cos(c + d*x) - d^2*x^2
*cos(c + d*x) + 2*d*x*sin(c + d*x)))/d^3
```

3.83. $\int \frac{(a+bx^3)\sin(c+dx)}{x}\,dx$

# 3.84 $\int \frac{(a+bx^3)\sin(c+dx)}{x^2}\,dx$



## 3.84.1 Optimal result

Integrand size = 17, antiderivative size = 56

$$\int \frac{(a+bx^3)\sin(c+dx)}{x^2}\,dx = -\frac{bx\cos(c+dx)}{d} + ad\cos(c)\,\text{CosIntegral}(dx) + \frac{b\sin(c+dx)}{d^2} - \frac{a\sin(c+dx)}{x} - ad\sin(c)\text{Si}(dx)$$

output
```
a*d*Ci(d*x)*cos(c)-b*x*cos(d*x+c)/d-a*d*Si(d*x)*sin(c)+b*sin(d*x+c)/d^2-a*
sin(d*x+c)/x
```

## 3.84.2 Mathematica [A] (verified)

Time = 0.08 (sec) , antiderivative size = 56, normalized size of antiderivative = 1.00

$$\int \frac{(a+bx^3)\sin(c+dx)}{x^2}\,dx = -\frac{bx\cos(c+dx)}{d} + ad\cos(c)\,\text{CosIntegral}(dx) + \frac{b\sin(c+dx)}{d^2} - \frac{a\sin(c+dx)}{x} - ad\sin(c)\text{Si}(dx)$$

input
```
Integrate[((a + b*x^3)*Sin[c + d*x])/x^2,x]
```

output
```
-((b*x*Cos[c + d*x])/d) + a*d*Cos[c]*CosIntegral[d*x] + (b*Sin[c + d*x])/d
^2 - (a*Sin[c + d*x])/x - a*d*Sin[c]*SinIntegral[d*x]
```

### 3.84.3 Rubi [A] (verified)

Time = 0.27 (sec) , antiderivative size = 56, normalized size of antiderivative = 1.00, number of steps used = 2, number of rules used = 2, $\frac{\text{number of rules}}{\text{integrand size}}$ = 0.118, Rules used = {3820, 2009}

Below are the steps used by Rubi to obtain the solution. The rule number used for the transformation is given above next to the arrow. The rules definitions used are listed below.

$$\int \frac{(a+bx^3)\sin(c+dx)}{x^2}dx$$

$$\Big\downarrow \ 3820$$

$$\int \left(\frac{a\sin(c+dx)}{x^2}+bx\sin(c+dx)\right)dx$$

$$\Big\downarrow \ 2009$$

$$ad\cos(c)\operatorname{CosIntegral}(dx)-ad\sin(c)\operatorname{Si}(dx)-\frac{a\sin(c+dx)}{x}+\frac{b\sin(c+dx)}{d^2}-\frac{bx\cos(c+dx)}{d}$$

input
```
Int[((a + b*x^3)*Sin[c + d*x])/x^2,x]
```

output
```
-((b*x*Cos[c + d*x])/d) + a*d*Cos[c]*CosIntegral[d*x] + (b*Sin[c + d*x])/d
^2 - (a*Sin[c + d*x])/x - a*d*Sin[c]*SinIntegral[d*x]
```

#### 3.84.3.1 Defintions of rubi rules used

rule 2009
```
Int[u_, x_Symbol] :> Simp[IntSum[u, x], x] /; SumQ[u]
```

rule 3820
```
Int[((e_.)*(x_))^(m_.)*((a_) + (b_.)*(x_)^(n_))^(p_.)*Sin[(c_.) + (d_.)*(x_
)], x_Symbol] :> Int[ExpandIntegrand[Sin[c + d*x], (e*x)^m*(a + b*x^n)^p, x
], x] /; FreeQ[{a, b, c, d, e, m, n}, x] && IGtQ[p, 0]
```

### 3.84.4 Maple [A] (verified)

Time = 0.21 (sec) , antiderivative size = 79, normalized size of antiderivative = 1.41

| method | result |
|---|---|
| derivativedivides | $d\left(a\left(-\frac{\sin(dx+c)}{dx}-\operatorname{Si}(dx)\sin(c)+\operatorname{Ci}(dx)\cos(c)\right)+\frac{3bc\cos(dx+c)}{d^3}+\frac{(2c+1)b(\sin(dx+c)-\cos(dx}{d^3}$ |
| default | $d\left(a\left(-\frac{\sin(dx+c)}{dx}-\operatorname{Si}(dx)\sin(c)+\operatorname{Ci}(dx)\cos(c)\right)+\frac{3bc\cos(dx+c)}{d^3}+\frac{(2c+1)b(\sin(dx+c)-\cos(dx}{d^3}$ |
| risch | $-\frac{-i\operatorname{Ei}_1(idx)\sin(c)a\,d^3x+i\sin(c)\operatorname{Ei}_1(-idx)a\,d^3x+\operatorname{Ei}_1(idx)\cos(c)a\,d^3x+\cos(c)\operatorname{Ei}_1(-idx)a\,d^3x+2\cos(dx+c)bd\,x^2+2}{2d^2x}$ |
| meijerg | $\frac{2b\sqrt{\pi}\,\sin(c)\left(-\frac{1}{2\sqrt{\pi}}+\frac{\cos(dx)}{2\sqrt{\pi}}+\frac{dx\sin(dx)}{2\sqrt{\pi}}\right)}{d^2}+\frac{2b\sqrt{\pi}\,\cos(c)\left(-\frac{dx\cos(dx)}{2\sqrt{\pi}}+\frac{\sin(dx)}{2\sqrt{\pi}}\right)}{d^2}+\frac{a\sqrt{\pi}\,\sin(c)d^2\Bigg(-\frac{4d^2\cos\left(x\sqrt{d^2}\right)}{x\left(d^2\right)^{\frac{3}{2}}\sqrt{\pi}}}{4\sqrt{d^2}}$ |

input
```
int((b*x^3+a)*sin(d*x+c)/x^2,x,method=_RETURNVERBOSE)
```

output
```
d*(a*(-sin(d*x+c)/d/x-Si(d*x)*sin(c)+Ci(d*x)*cos(c))+3*b/d^3*c*cos(d*x+c)+
(2*c+1)/d^3*b*(sin(d*x+c)-cos(d*x+c)*(d*x+c)))
```

### 3.84.5 Fricas [A] (verification not implemented)

Time = 0.28 (sec) , antiderivative size = 64, normalized size of antiderivative = 1.14

$$\int \frac{(a+bx^3)\sin(c+dx)}{x^2}\,dx = \frac{ad^3x\cos(c)\operatorname{Ci}(dx)-ad^3x\sin(c)\operatorname{Si}(dx)-bdx^2\cos(dx+c)-(ad^2-bx)\sin(dx+c)}{d^2x}$$

input
```
integrate((b*x^3+a)*sin(d*x+c)/x^2,x, algorithm="fricas")
```

output
```
(a*d^3*x*cos(c)*cos_integral(d*x) - a*d^3*x*sin(c)*sin_integral(d*x) - b*d
*x^2*cos(d*x + c) - (a*d^2 - b*x)*sin(d*x + c))/(d^2*x)
```

### 3.84.6 Sympy [F]

$$\int \frac{(a+bx^3)\sin(c+dx)}{x^2}\,dx = \int \frac{(a+bx^3)\sin{(c+dx)}}{x^2}\,dx$$

input
```
integrate((b*x**3+a)*sin(d*x+c)/x**2,x)
```

output
```
Integral((a + b*x**3)*sin(c + d*x)/x**2, x)
```

### 3.84.7 Maxima [C] (verification not implemented)

Result contains complex when optimal does not.

Time = 0.54 (sec) , antiderivative size = 69, normalized size of antiderivative = 1.23

$$\int \frac{(a+bx^3)\sin(c+dx)}{x^2}\,dx$$
$$= \frac{(a(\Gamma(-1,i\,dx)+\Gamma(-1,-i\,dx))\cos{(c)}+a(-i\,\Gamma(-1,i\,dx)+i\,\Gamma(-1,-i\,dx))\sin{(c)})d^3-2\,bdx\cos{(dx+c}}{2\,d^2}$$

input
```
integrate((b*x^3+a)*sin(d*x+c)/x^2,x, algorithm="maxima")
```

output
```
1/2*((a*(gamma(-1, I*d*x) + gamma(-1, -I*d*x))*cos(c) + a*(-I*gamma(-1, I*
d*x) + I*gamma(-1, -I*d*x))*sin(c))*d^3 - 2*b*d*x*cos(d*x + c) + 2*b*sin(d
*x + c))/d^2
```

### 3.84.8 Giac [C] (verification not implemented)

Result contains higher order function than in optimal. Order 9 vs. order 4.

Time = 0.30 (sec) , antiderivative size = 489, normalized size of antiderivative = 8.73

$$\int \frac{(a+bx^3)\sin(c+dx)}{x^2}\,dx =$$
$$-\frac{ad^3x\Re(\mathrm{Ci}\,(dx))\tan\left(\frac{1}{2}\,dx\right)^2\tan\left(\frac{1}{2}\,c\right)^2+ad^3x\Re(\mathrm{Ci}\,(-dx))\tan\left(\frac{1}{2}\,dx\right)^2\tan\left(\frac{1}{2}\,c\right)^2+2\,ad^3x\Im(\mathrm{Ci}\,(dx))\tan}{}$$

input
```
integrate((b*x^3+a)*sin(d*x+c)/x^2,x, algorithm="giac")
```

output
```
-1/2*(a*d^3*x*real_part(cos_integral(d*x))*tan(1/2*d*x)^2*tan(1/2*c)^2 + a
*d^3*x*real_part(cos_integral(-d*x))*tan(1/2*d*x)^2*tan(1/2*c)^2 + 2*a*d^3
*x*imag_part(cos_integral(d*x))*tan(1/2*d*x)^2*tan(1/2*c) - 2*a*d^3*x*imag
_part(cos_integral(-d*x))*tan(1/2*d*x)^2*tan(1/2*c) + 4*a*d^3*x*sin_integr
al(d*x)*tan(1/2*d*x)^2*tan(1/2*c) - a*d^3*x*real_part(cos_integral(d*x))*t
an(1/2*d*x)^2 - a*d^3*x*real_part(cos_integral(-d*x))*tan(1/2*d*x)^2 + a*d
^3*x*real_part(cos_integral(d*x))*tan(1/2*c)^2 + a*d^3*x*real_part(cos_int
egral(-d*x))*tan(1/2*c)^2 + 2*b*d*x^2*tan(1/2*d*x)^2*tan(1/2*c)^2 + 2*a*d^
3*x*imag_part(cos_integral(d*x))*tan(1/2*c) - 2*a*d^3*x*imag_part(cos_inte
gral(-d*x))*tan(1/2*c) + 4*a*d^3*x*sin_integral(d*x)*tan(1/2*c) - a*d^3*x*
real_part(cos_integral(d*x)) - a*d^3*x*real_part(cos_integral(-d*x)) - 2*b
*d*x^2*tan(1/2*d*x)^2 - 8*b*d*x^2*tan(1/2*d*x)*tan(1/2*c) - 4*a*d^2*tan(1/
2*d*x)^2*tan(1/2*c) - 2*b*d*x^2*tan(1/2*c)^2 - 4*a*d^2*tan(1/2*d*x)*tan(1/
2*c)^2 + 4*b*x*tan(1/2*d*x)^2*tan(1/2*c) + 4*b*x*tan(1/2*d*x)*tan(1/2*c)^2
 + 2*b*d*x^2 + 4*a*d^2*tan(1/2*d*x) + 4*a*d^2*tan(1/2*c) - 4*b*x*tan(1/2*d
*x) - 4*b*x*tan(1/2*c))/(d^2*x*tan(1/2*d*x)^2*tan(1/2*c)^2 + d^2*x*tan(1/2
*d*x)^2 + d^2*x*tan(1/2*c)^2 + d^2*x)
```

### 3.84.9 Mupad [F(-1)]

Timed out.

$$\int \frac{(a+bx^3)\sin(c+dx)}{x^2}\,dx = \int \frac{\sin(c+d\,x)\,\left(b\,x^3+a\right)}{x^2}\,dx$$

input
```
int((sin(c + d*x)*(a + b*x^3))/x^2,x)
```

output
```
int((sin(c + d*x)*(a + b*x^3))/x^2, x)
```

# 3.85 $\int \frac{(a+bx^3)\sin(c+dx)}{x^3}\,dx$



## 3.85.1 Optimal result

Integrand size = 17, antiderivative size = 70

$$\int \frac{(a+bx^3)\sin(c+dx)}{x^3}\,dx = -\frac{b\cos(c+dx)}{d}-\frac{ad\cos(c+dx)}{2x}-\frac{1}{2}ad^2\,\text{CosIntegral}(dx)\sin(c)-\frac{a\sin(c+dx)}{2x^2}-\frac{1}{2}ad^2\cos(c)\text{Si}(dx)$$

output
```
-b*cos(d*x+c)/d-1/2*a*d*cos(d*x+c)/x-1/2*a*d^2*cos(c)*Si(d*x)-1/2*a*d^2*Ci
(d*x)*sin(c)-1/2*a*sin(d*x+c)/x^2
```

## 3.85.2 Mathematica [A] (verified)

Time = 0.09 (sec) , antiderivative size = 66, normalized size of antiderivative = 0.94

$$\int \frac{(a+bx^3)\sin(c+dx)}{x^3}\,dx = \frac{1}{2}\left(-\frac{2b\cos(c+dx)}{d}-\frac{ad\cos(c+dx)}{x}-ad^2\,\text{CosIntegral}(dx)\sin(c)-\frac{a\sin(c+dx)}{x^2}-ad^2\cos(c)\text{Si}(dx)\right)$$

input
```
Integrate[((a + b*x^3)*Sin[c + d*x])/x^3,x]
```

output
```
((-2*b*Cos[c + d*x])/d - (a*d*Cos[c + d*x])/x - a*d^2*CosIntegral[d*x]*Sin
[c] - (a*Sin[c + d*x])/x^2 - a*d^2*Cos[c]*SinIntegral[d*x])/2
```

### 3.85.3 Rubi [A] (verified)

Time = 0.28 (sec) , antiderivative size = 70, normalized size of antiderivative = 1.00, number of steps used = 2, number of rules used = 2, $\frac{\text{number of rules}}{\text{integrand size}}$ = 0.118, Rules used = {3820, 2009}

Below are the steps used by Rubi to obtain the solution. The rule number used for the transformation is given above next to the arrow. The rules definitions used are listed below.

$$\int \frac{(a+bx^3)\sin(c+dx)}{x^3}\,dx$$

$$\Big\downarrow \ 3820$$

$$\int \left(\frac{a\sin(c+dx)}{x^3}+b\sin(c+dx)\right)dx$$

$$\Big\downarrow \ 2009$$

$$-\frac{1}{2}ad^2\sin(c)\,\text{CosIntegral}(dx)-\frac{1}{2}ad^2\cos(c)\text{Si}(dx)-\frac{a\sin(c+dx)}{2x^2}-\frac{ad\cos(c+dx)}{2x}-\frac{b\cos(c+dx)}{d}$$

input
```
Int[((a + b*x^3)*Sin[c + d*x])/x^3,x]
```

output
```
-((b*Cos[c + d*x])/d) - (a*d*Cos[c + d*x])/(2*x) - (a*d^2*CosIntegral[d*x]
*Sin[c])/2 - (a*Sin[c + d*x])/(2*x^2) - (a*d^2*Cos[c]*SinIntegral[d*x])/2
```

#### 3.85.3.1 Defintions of rubi rules used

rule 2009
```
Int[u_, x_Symbol] :> Simp[IntSum[u, x], x] /; SumQ[u]
```

rule 3820
```
Int[((e_.)*(x_))^(m_.)*((a_) + (b_.)*(x_)^(n_))^(p_.)*Sin[(c_.) + (d_.)*(x_
)], x_Symbol] :> Int[ExpandIntegrand[Sin[c + d*x], (e*x)^m*(a + b*x^n)^p, x
], x] /; FreeQ[{a, b, c, d, e, m, n}, x] && IGtQ[p, 0]
```

### 3.85.4 Maple [A] (verified)

Time = 0.20 (sec) , antiderivative size = 65, normalized size of antiderivative = 0.93

| method | result |
|---|---|
| derivativedivides | $d^{2}\left(a\left(-\frac{\sin(dx+c)}{2d^{2}x^{2}}-\frac{\cos(dx+c)}{2dx}-\frac{\operatorname{Si}(dx)\cos(c)}{2}-\frac{\operatorname{Ci}(dx)\sin(c)}{2}\right)-\frac{b\cos(dx+c)}{d^{3}}\right)$ |
| default | $d^{2}\left(a\left(-\frac{\sin(dx+c)}{2d^{2}x^{2}}-\frac{\cos(dx+c)}{2dx}-\frac{\operatorname{Si}(dx)\cos(c)}{2}-\frac{\operatorname{Ci}(dx)\sin(c)}{2}\right)-\frac{b\cos(dx+c)}{d^{3}}\right)$ |
| risch | $-\frac{id^{2}\cos(c)a\ \operatorname{Ei}_{1}(-idx)}{4}+\frac{id^{2}\cos(c)a\ \operatorname{Ei}_{1}(idx)}{4}+\frac{d^{2}\sin(c)a\ \operatorname{Ei}_{1}(-idx)}{4}+\frac{d^{2}\sin(c)a\ \operatorname{Ei}_{1}(idx)}{4}-\frac{i(-2ia\,d^{6}x^{3}-4}{4}$ |
| meijerg | $\frac{b\sin(c)\sin(dx)}{d}+\frac{b\sqrt{\pi}\,\cos(c)\left(\frac{1}{\sqrt{\pi}}-\frac{\cos(dx)}{\sqrt{\pi}}\right)}{d}+\frac{a\sqrt{\pi}\,\sin(c)d^{2}\left(-\frac{4}{\sqrt{\pi}\,x^{2}d^{2}}-\frac{2\left(2\gamma-3+2\ln(x)+\ln\left(d^{2}\right)\right)}{\sqrt{\pi}}+\frac{-6d^{2}x^{2}+4}{\sqrt{\pi}\,x^{2}d^{2}}+\frac{4\gamma}{\sqrt{}}\right.}{8}$ |

input
```
int((b*x^3+a)*sin(d*x+c)/x^3,x,method=_RETURNVERBOSE)
```

output
```
d^2*(a*(-1/2*sin(d*x+c)/d^2/x^2-1/2*cos(d*x+c)/d/x-1/2*Si(d*x)*cos(c)-1/2*
Ci(d*x)*sin(c))-b*cos(d*x+c)/d^3)
```

### 3.85.5 Fricas [A] (verification not implemented)

Time = 0.27 (sec) , antiderivative size = 66, normalized size of antiderivative = 0.94

$$\int\frac{(a+bx^{3})\sin(c+dx)}{x^{3}}\,dx=-\frac{ad^{3}x^{2}\operatorname{Ci}(dx)\sin(c)+ad^{3}x^{2}\cos(c)\operatorname{Si}(dx)+ad\sin(dx+c)+(ad^{2}x+2\,bx^{2})\cos(dx+c)}{2\,dx^{2}}$$

input
```
integrate((b*x^3+a)*sin(d*x+c)/x^3,x, algorithm="fricas")
```

output
```
-1/2*(a*d^3*x^2*cos_integral(d*x)*sin(c) + a*d^3*x^2*cos(c)*sin_integral(d
*x) + a*d*sin(d*x + c) + (a*d^2*x + 2*b*x^2)*cos(d*x + c))/(d*x^2)
```

### 3.85.6 Sympy [F]

$$\int \frac{(a+bx^3)\sin(c+dx)}{x^3}\,dx = \int \frac{(a+bx^3)\sin{(c+dx)}}{x^3}\,dx$$

input
```
integrate((b*x**3+a)*sin(d*x+c)/x**3,x)
```

output
```
Integral((a + b*x**3)*sin(c + d*x)/x**3, x)
```

### 3.85.7 Maxima [C] (verification not implemented)

Result contains complex when optimal does not.

Time = 0.45 (sec) , antiderivative size = 1146, normalized size of antiderivative = 16.37

$$\int \frac{(a+bx^3)\sin(c+dx)}{x^3}\,dx = \text{Too large to display}$$

input
```
integrate((b*x^3+a)*sin(d*x+c)/x^3,x, algorithm="maxima")
```

output
```
1/4*(((I*exp_integral_e(3, I*d*x) - I*exp_integral_e(3, -I*d*x))*cos(c)^3
+ (I*exp_integral_e(3, I*d*x) - I*exp_integral_e(3, -I*d*x))*cos(c)*sin(c)
^2 + (exp_integral_e(3, I*d*x) + exp_integral_e(3, -I*d*x))*sin(c)^3 + (I*
exp_integral_e(3, I*d*x) - I*exp_integral_e(3, -I*d*x))*cos(c) + ((exp_int
egral_e(3, I*d*x) + exp_integral_e(3, -I*d*x))*cos(c)^2 + exp_integral_e(3
, I*d*x) + exp_integral_e(3, -I*d*x))*sin(c))*b*c^3/((d*x + c)^2*(cos(c)^2
 + sin(c)^2)*d^3 - 2*(c*cos(c)^2 + c*sin(c)^2)*(d*x + c)*d^3 + (c^2*cos(c)
^2 + c^2*sin(c)^2)*d^3) - ((I*exp_integral_e(3, I*d*x) - I*exp_integral_e(
3, -I*d*x))*cos(c)^3 + (I*exp_integral_e(3, I*d*x) - I*exp_integral_e(3, -
I*d*x))*cos(c)*sin(c)^2 + (exp_integral_e(3, I*d*x) + exp_integral_e(3, -I
*d*x))*sin(c)^3 + (I*exp_integral_e(3, I*d*x) - I*exp_integral_e(3, -I*d*x
))*cos(c) + ((exp_integral_e(3, I*d*x) + exp_integral_e(3, -I*d*x))*cos(c)
^2 + exp_integral_e(3, I*d*x) + exp_integral_e(3, -I*d*x))*sin(c))*a/(c^2*
cos(c)^2 + c^2*sin(c)^2 + (d*x + c)^2*(cos(c)^2 + sin(c)^2) - 2*(c*cos(c)^
2 + c*sin(c)^2)*(d*x + c)) - (2*((b*cos(c)^2 + b*sin(c)^2)*(d*x + c)^3 - 3
*(b*c*cos(c)^2 + b*c*sin(c)^2)*(d*x + c)^2 + 3*(b*c^2*cos(c)^2 + b*c^2*sin
(c)^2)*(d*x + c))*cos(d*x + c)^3 - 3*(b*c^3*(exp_integral_e(4, I*d*x) + ex
p_integral_e(4, -I*d*x))*cos(c)^3 + b*c^3*(exp_integral_e(4, I*d*x) + exp_
integral_e(4, -I*d*x))*cos(c)*sin(c)^2 + b*c^3*(-I*exp_integral_e(4, I*d*x
) + I*exp_integral_e(4, -I*d*x))*sin(c)^3 + b*c^3*(exp_integral_e(4, I*...
```

### 3.85.8 Giac [C] (verification not implemented)

Result contains higher order function than in optimal. Order 9 vs. order 4.

Time = 0.32 (sec) , antiderivative size = 564, normalized size of antiderivative = 8.06

$$\int \frac{(a+bx^3)\sin(c+dx)}{x^3}\,dx$$
$$= \frac{ad^3x^2\Im(\mathrm{Ci}\,(dx))\tan\left(\frac{1}{2}\,dx\right)^2\tan\left(\frac{1}{2}\,c\right)^2 - ad^3x^2\Im(\mathrm{Ci}\,(-dx))\tan\left(\frac{1}{2}\,dx\right)^2\tan\left(\frac{1}{2}\,c\right)^2 + 2\,ad^3x^2\,\mathrm{Si}\,(dx)\tan\left(\frac{1}{2}\right.}{}$$

input
```
integrate((b*x^3+a)*sin(d*x+c)/x^3,x, algorithm="giac")
```

output
```
1/4*(a*d^3*x^2*imag_part(cos_integral(d*x))*tan(1/2*d*x)^2*tan(1/2*c)^2 -
a*d^3*x^2*imag_part(cos_integral(-d*x))*tan(1/2*d*x)^2*tan(1/2*c)^2 + 2*a*
d^3*x^2*sin_integral(d*x)*tan(1/2*d*x)^2*tan(1/2*c)^2 - 2*a*d^3*x^2*real_p
art(cos_integral(d*x))*tan(1/2*d*x)^2*tan(1/2*c) - 2*a*d^3*x^2*real_part(c
os_integral(-d*x))*tan(1/2*d*x)^2*tan(1/2*c) - a*d^3*x^2*imag_part(cos_int
egral(d*x))*tan(1/2*d*x)^2 + a*d^3*x^2*imag_part(cos_integral(-d*x))*tan(1
/2*d*x)^2 - 2*a*d^3*x^2*sin_integral(d*x)*tan(1/2*d*x)^2 + a*d^3*x^2*imag_
part(cos_integral(d*x))*tan(1/2*c)^2 - a*d^3*x^2*imag_part(cos_integral(-d
*x))*tan(1/2*c)^2 + 2*a*d^3*x^2*sin_integral(d*x)*tan(1/2*c)^2 - 2*a*d^3*x
^2*real_part(cos_integral(d*x))*tan(1/2*c) - 2*a*d^3*x^2*real_part(cos_int
egral(-d*x))*tan(1/2*c) - 2*a*d^2*x*tan(1/2*d*x)^2*tan(1/2*c)^2 - a*d^3*x^
2*imag_part(cos_integral(d*x)) + a*d^3*x^2*imag_part(cos_integral(-d*x)) -
 2*a*d^3*x^2*sin_integral(d*x) - 4*b*x^2*tan(1/2*d*x)^2*tan(1/2*c)^2 + 2*a
*d^2*x*tan(1/2*d*x)^2 + 8*a*d^2*x*tan(1/2*d*x)*tan(1/2*c) + 2*a*d^2*x*tan(
1/2*c)^2 + 4*b*x^2*tan(1/2*d*x)^2 + 16*b*x^2*tan(1/2*d*x)*tan(1/2*c) + 4*a
*d*tan(1/2*d*x)^2*tan(1/2*c) + 4*b*x^2*tan(1/2*c)^2 + 4*a*d*tan(1/2*d*x)*t
an(1/2*c)^2 - 2*a*d^2*x - 4*b*x^2 - 4*a*d*tan(1/2*d*x) - 4*a*d*tan(1/2*c))
/(d*x^2*tan(1/2*d*x)^2*tan(1/2*c)^2 + d*x^2*tan(1/2*d*x)^2 + d*x^2*tan(1/2
*c)^2 + d*x^2)
```

### 3.85.9 Mupad [F(-1)]

Timed out.

$$\int \frac{(a+bx^3)\sin(c+dx)}{x^3}\,dx = \int \frac{\sin\left(c+d\,x\right)\,\left(b\,x^3+a\right)}{x^3}\,dx$$

input
```
int((sin(c + d*x)*(a + b*x^3))/x^3,x)
```

output
```
int((sin(c + d*x)*(a + b*x^3))/x^3, x)
```

# 3.86 $\int \frac{(a+bx^3)\sin(c+dx)}{x^4}\,dx$



## 3.86.1 Optimal result

Integrand size = 17, antiderivative size = 91

$$\int \frac{(a+bx^3)\sin(c+dx)}{x^4}\,dx = -\frac{ad\cos(c+dx)}{6x^2}-\frac{1}{6}ad^3\cos(c)\,\text{CosIntegral}(dx)+b\,\text{CosIntegral}(dx)\sin(c)-\frac{a\sin(c+dx)}{3x^3}+\frac{ad^2\sin(c+dx)}{6x}+b\cos(c)\text{Si}(dx)+\frac{1}{6}ad^3\sin(c)\text{Si}(dx)$$

output
```
-1/6*a*d^3*Ci(d*x)*cos(c)-1/6*a*d*cos(d*x+c)/x^2+b*cos(c)*Si(d*x)+b*Ci(d*x
)*sin(c)+1/6*a*d^3*Si(d*x)*sin(c)-1/3*a*sin(d*x+c)/x^3+1/6*a*d^2*sin(d*x+c
)/x
```

## 3.86.2 Mathematica [A] (verified)

Time = 0.12 (sec) , antiderivative size = 104, normalized size of antiderivative = 1.14

$$\int \frac{(a+bx^3)\sin(c+dx)}{x^4}\,dx = b\,\text{CosIntegral}(dx)\sin(c)+\frac{a\cos(dx)\left(-dx\cos(c)-2\sin(c)+d^2x^2\sin(c)\right)}{6x^3}+\frac{a(-2\cos(c)+d^2x^2\cos(c)+dx\sin(c))\sin(dx)}{6x^3}+b\cos(c)\text{Si}(dx)-\frac{1}{6}ad^3(\cos(c)\,\text{CosIntegral}(dx)-\sin(c)\text{Si}(dx))$$

input
```
Integrate[((a + b*x^3)*Sin[c + d*x])/x^4,x]
```

output
```
b*CosIntegral[d*x]*Sin[c] + (a*Cos[d*x]*(-(d*x*Cos[c]) - 2*Sin[c] + d^2*x^
2*Sin[c]))/(6*x^3) + (a*(-2*Cos[c] + d^2*x^2*Cos[c] + d*x*Sin[c])*Sin[d*x]
)/(6*x^3) + b*Cos[c]*SinIntegral[d*x] - (a*d^3*(Cos[c]*CosIntegral[d*x] -
Sin[c]*SinIntegral[d*x]))/6
```

## 3.86.3 Rubi [A] (verified)

Time = 0.35 (sec) , antiderivative size = 91, normalized size of antiderivative = 1.00, number of steps used = 2, number of rules used = 2, $\frac{\text{number of rules}}{\text{integrand size}}$ = 0.118, Rules used = {3820, 2009}

Below are the steps used by Rubi to obtain the solution. The rule number used for the transformation is given above next to the arrow. The rules definitions used are listed below.

$$\int \frac{(a+bx^3)\sin(c+dx)}{x^4}\,dx$$

$$\Big\downarrow \text{3820}$$

$$\int \left(\frac{a\sin(c+dx)}{x^4}+\frac{b\sin(c+dx)}{x}\right)dx$$

$$\Big\downarrow \text{2009}$$

$$-\frac{1}{6}ad^3\cos(c)\,\text{CosIntegral}(dx)+\frac{1}{6}ad^3\sin(c)\text{Si}(dx)+\frac{ad^2\sin(c+dx)}{6x}-\frac{a\sin(c+dx)}{3x^3}-\frac{ad\cos(c+dx)}{6x^2}+b\sin(c)\,\text{CosIntegral}(dx)+b\cos(c)\text{Si}(dx)$$

input
```
Int[((a + b*x^3)*Sin[c + d*x])/x^4,x]
```

output
```
-1/6*(a*d*Cos[c + d*x])/x^2 - (a*d^3*Cos[c]*CosIntegral[d*x])/6 + b*CosInt
egral[d*x]*Sin[c] - (a*Sin[c + d*x])/(3*x^3) + (a*d^2*Sin[c + d*x])/(6*x)
+ b*Cos[c]*SinIntegral[d*x] + (a*d^3*Sin[c]*SinIntegral[d*x])/6
```

#### 3.86.3.1 Defintions of rubi rules used

rule 2009
```
Int[u_, x_Symbol] :> Simp[IntSum[u, x], x] /; SumQ[u]
```

rule 3820
```
Int[((e_.)*(x_))^(m_.)*((a_) + (b_.)*(x_)^(n_))^(p_.)*Sin[(c_.) + (d_.)*(x_
)], x_Symbol] :> Int[ExpandIntegrand[Sin[c + d*x], (e*x)^m*(a + b*x^n)^p, x
], x] /; FreeQ[{a, b, c, d, e, m, n}, x] && IGtQ[p, 0]
```

### 3.86.4 Maple [A] (verified)

Time = 0.22 (sec) , antiderivative size = 87, normalized size of antiderivative = 0.96

| method | result |
|---|---|
| derivativedivides | $d^3\left(a\left(-\frac{\sin(dx+c)}{3d^3x^3}-\frac{\cos(dx+c)}{6d^2x^2}+\frac{\sin(dx+c)}{6dx}+\frac{\mathrm{Si}(dx)\sin(c)}{6}-\frac{\mathrm{Ci}(dx)\cos(c)}{6}\right)+\frac{b(\mathrm{Si}(dx)\cos(c)+\mathrm{Ci}(dx)\sin}{d^3}\right.$ |
| default | $d^3\left(a\left(-\frac{\sin(dx+c)}{3d^3x^3}-\frac{\cos(dx+c)}{6d^2x^2}+\frac{\sin(dx+c)}{6dx}+\frac{\mathrm{Si}(dx)\sin(c)}{6}-\frac{\mathrm{Ci}(dx)\cos(c)}{6}\right)+\frac{b(\mathrm{Si}(dx)\cos(c)+\mathrm{Ci}(dx)\sin}{d^3}\right.$ |
| risch | $\frac{\cos(c)\,\mathrm{Ei}_1(-idx)a\,d^3}{12}-\frac{i\cos(c)\,\mathrm{Ei}_1(idx)b}{2}+\frac{\cos(c)\,\mathrm{Ei}_1(idx)a\,d^3}{12}+\frac{i\cos(c)\,\mathrm{Ei}_1(-idx)b}{2}+\frac{i\sin(c)\,\mathrm{Ei}_1(-idx)a\,d^3}{12}-$ |
| meijerg | $\frac{b\sqrt{\pi}\,\sin(c)\left(\frac{2\gamma+2\ln(x)+\ln(d^2)}{\sqrt{\pi}}-\frac{2\gamma}{\sqrt{\pi}}-\frac{2\ln(2)}{\sqrt{\pi}}-\frac{2\ln\left(\frac{dx}{2}\right)}{\sqrt{\pi}}+\frac{2\,\mathrm{Ci}(dx)}{\sqrt{\pi}}\right)}{2}+b\cos(c)\,\mathrm{Si}(dx)+\frac{a\sqrt{\pi}\,\sin(c)d^4\left(-\frac{8(-d}{}\right.}{}$ |

input
```
int((b*x^3+a)*sin(d*x+c)/x^4,x,method=_RETURNVERBOSE)
```

output
```
d^3*(a*(-1/3*sin(d*x+c)/d^3/x^3-1/6*cos(d*x+c)/d^2/x^2+1/6*sin(d*x+c)/d/x+
1/6*Si(d*x)*sin(c)-1/6*Ci(d*x)*cos(c))+1/d^3*b*(Si(d*x)*cos(c)+Ci(d*x)*sin
(c)))
```

### 3.86.5 Fricas [A] (verification not implemented)

Time = 0.28 (sec) , antiderivative size = 89, normalized size of antiderivative = 0.98

$$\int \frac{(a+bx^3)\sin(c+dx)}{x^4}\,dx = -\frac{adx\cos(dx+c)+(ad^3x^3\,\mathrm{Ci}(dx)-6\,bx^3\,\mathrm{Si}(dx))\cos(c)-(ad^2x^2-2\,a)\sin(dx+c)-(ad^3x^3\,\mathrm{Si}(dx)+}{6\,x^3}$$

input
```
integrate((b*x^3+a)*sin(d*x+c)/x^4,x, algorithm="fricas")
```

output
```
-1/6*(a*d*x*cos(d*x + c) + (a*d^3*x^3*cos_integral(d*x) - 6*b*x^3*sin_inte
gral(d*x))*cos(c) - (a*d^2*x^2 - 2*a)*sin(d*x + c) - (a*d^3*x^3*sin_integr
al(d*x) + 6*b*x^3*cos_integral(d*x))*sin(c))/x^3
```

### 3.86.6 Sympy [F]

$$\int \frac{(a+bx^3)\sin(c+dx)}{x^4}\,dx = \int \frac{(a+bx^3)\sin{(c+dx)}}{x^4}\,dx$$

input
```
integrate((b*x**3+a)*sin(d*x+c)/x**4,x)
```

output
```
Integral((a + b*x**3)*sin(c + d*x)/x**4, x)
```

### 3.86.7 Maxima [C] (verification not implemented)

Result contains complex when optimal does not.

Time = 0.90 (sec) , antiderivative size = 132, normalized size of antiderivative = 1.45

$$\int \frac{(a+bx^3)\sin(c+dx)}{x^4}\,dx = -\frac{((a(\Gamma(-3,i\,dx)+\Gamma(-3,-i\,dx))\cos{(c)}+a(-i\,\Gamma(-3,i\,dx)+i\,\Gamma(-3,-i\,dx))\sin{(c)})d^6-6\,(b(i\,\Gamma(-3,i\,\ldots}{\ldots}$$

input
```
integrate((b*x^3+a)*sin(d*x+c)/x^4,x, algorithm="maxima")
```

output
```
-1/2*(((a*(gamma(-3, I*d*x) + gamma(-3, -I*d*x))*cos(c) + a*(-I*gamma(-3,
I*d*x) + I*gamma(-3, -I*d*x))*sin(c))*d^6 - 6*(b*(I*gamma(-3, I*d*x) - I*g
amma(-3, -I*d*x))*cos(c) + b*(gamma(-3, I*d*x) + gamma(-3, -I*d*x))*sin(c)
)*d^3)*x^3 + 2*b*d*x*sin(d*x + c) + 2*(b*d^2*x^2 - 2*b)*cos(d*x + c))/(d^3
*x^3)
```

### 3.86.8 Giac [C] (verification not implemented)

Result contains higher order function than in optimal. Order 9 vs. order 4.

Time = 0.30 (sec) , antiderivative size = 796, normalized size of antiderivative = 8.75

$$\int \frac{(a+bx^3)\sin(c+dx)}{x^4} \, dx = \text{Too large to display}$$

input
```
integrate((b*x^3+a)*sin(d*x+c)/x^4,x, algorithm="giac")
```

output
```
1/12*(a*d^3*x^3*real_part(cos_integral(d*x))*tan(1/2*d*x)^2*tan(1/2*c)^2 +
 a*d^3*x^3*real_part(cos_integral(-d*x))*tan(1/2*d*x)^2*tan(1/2*c)^2 + 2*a
*d^3*x^3*imag_part(cos_integral(d*x))*tan(1/2*d*x)^2*tan(1/2*c) - 2*a*d^3*
x^3*imag_part(cos_integral(-d*x))*tan(1/2*d*x)^2*tan(1/2*c) + 4*a*d^3*x^3*
sin_integral(d*x)*tan(1/2*d*x)^2*tan(1/2*c) - a*d^3*x^3*real_part(cos_inte
gral(d*x))*tan(1/2*d*x)^2 - a*d^3*x^3*real_part(cos_integral(-d*x))*tan(1/
2*d*x)^2 + a*d^3*x^3*real_part(cos_integral(d*x))*tan(1/2*c)^2 + a*d^3*x^3
*real_part(cos_integral(-d*x))*tan(1/2*c)^2 + 2*a*d^3*x^3*imag_part(cos_in
tegral(d*x))*tan(1/2*c) - 2*a*d^3*x^3*imag_part(cos_integral(-d*x))*tan(1/
2*c) + 4*a*d^3*x^3*sin_integral(d*x)*tan(1/2*c) - 6*b*x^3*imag_part(cos_in
tegral(d*x))*tan(1/2*d*x)^2*tan(1/2*c)^2 + 6*b*x^3*imag_part(cos_integral(
-d*x))*tan(1/2*d*x)^2*tan(1/2*c)^2 - 12*b*x^3*sin_integral(d*x)*tan(1/2*d*
x)^2*tan(1/2*c)^2 - a*d^3*x^3*real_part(cos_integral(d*x)) - a*d^3*x^3*rea
l_part(cos_integral(-d*x)) - 4*a*d^2*x^2*tan(1/2*d*x)^2*tan(1/2*c) + 12*b*
x^3*real_part(cos_integral(d*x))*tan(1/2*d*x)^2*tan(1/2*c) + 12*b*x^3*real
_part(cos_integral(-d*x))*tan(1/2*d*x)^2*tan(1/2*c) - 4*a*d^2*x^2*tan(1/2*
d*x)*tan(1/2*c)^2 + 6*b*x^3*imag_part(cos_integral(d*x))*tan(1/2*d*x)^2 -
6*b*x^3*imag_part(cos_integral(-d*x))*tan(1/2*d*x)^2 + 12*b*x^3*sin_integr
al(d*x)*tan(1/2*d*x)^2 - 6*b*x^3*imag_part(cos_integral(d*x))*tan(1/2*c)^2
 + 6*b*x^3*imag_part(cos_integral(-d*x))*tan(1/2*c)^2 - 12*b*x^3*sin_in...
```

### 3.86.9 Mupad [F(-1)]

Timed out.

$$\int \frac{(a+bx^3)\sin(c+dx)}{x^4} \, dx = \int \frac{\sin(c+d\,x)\,(b\,x^3+a)}{x^4} \, dx$$

input
```
int((sin(c + d*x)*(a + b*x^3))/x^4,x)
```

output
```
int((sin(c + d*x)*(a + b*x^3))/x^4, x)
```

# 3.87 $\int x(a+bx^3)^2 \sin(c+dx)\,dx$



## 3.87.1 Optimal result

Integrand size = 17, antiderivative size = 235

$$\begin{aligned}\int x\left(a+bx^3\right)^2\sin(c+dx)\,dx =& -\frac{48ab\cos(c+dx)}{d^5}+\frac{5040b^2x\cos(c+dx)}{d^7}-\frac{a^2x\cos(c+dx)}{d}\\&+\frac{24abx^2\cos(c+dx)}{d^3}-\frac{840b^2x^3\cos(c+dx)}{d^5}\\&-\frac{2abx^4\cos(c+dx)}{d}+\frac{42b^2x^5\cos(c+dx)}{d^3}-\frac{b^2x^7\cos(c+dx)}{d}\\&-\frac{5040b^2\sin(c+dx)}{d^8}+\frac{a^2\sin(c+dx)}{d^2}-\frac{48abx\sin(c+dx)}{d^4}\\&+\frac{2520b^2x^2\sin(c+dx)}{d^6}+\frac{8abx^3\sin(c+dx)}{d^2}\\&-\frac{210b^2x^4\sin(c+dx)}{d^4}+\frac{7b^2x^6\sin(c+dx)}{d^2}\end{aligned}$$

output
```
-48*a*b*cos(d*x+c)/d^5+5040*b^2*x*cos(d*x+c)/d^7-a^2*x*cos(d*x+c)/d+24*a*b
*x^2*cos(d*x+c)/d^3-840*b^2*x^3*cos(d*x+c)/d^5-2*a*b*x^4*cos(d*x+c)/d+42*b
^2*x^5*cos(d*x+c)/d^3-b^2*x^7*cos(d*x+c)/d-5040*b^2*sin(d*x+c)/d^8+a^2*sin
(d*x+c)/d^2-48*a*b*x*sin(d*x+c)/d^4+2520*b^2*x^2*sin(d*x+c)/d^6+8*a*b*x^3*
sin(d*x+c)/d^2-210*b^2*x^4*sin(d*x+c)/d^4+7*b^2*x^6*sin(d*x+c)/d^2
```

### 3.87.2 Mathematica [A] (verified)

Time = 0.24 (sec) , antiderivative size = 139, normalized size of antiderivative = 0.59

$$\int x\left(a+bx^3\right)^2\sin(c+dx)\,dx$$
$$=\frac{-d(a^2d^6x+2abd^2(24-12d^2x^2+d^4x^4)+b^2x(-5040+840d^2x^2-42d^4x^4+d^6x^6))\cos(c+dx)+(a^2d^6+\ldots}{d^8}$$

input
```
Integrate[x*(a + b*x^3)^2*Sin[c + d*x],x]
```

output
```
(-(d*(a^2*d^6*x + 2*a*b*d^2*(24 - 12*d^2*x^2 + d^4*x^4) + b^2*x*(-5040 + 8
40*d^2*x^2 - 42*d^4*x^4 + d^6*x^6))*Cos[c + d*x]) + (a^2*d^6 + 8*a*b*d^4*x
*(-6 + d^2*x^2) + 7*b^2*(-720 + 360*d^2*x^2 - 30*d^4*x^4 + d^6*x^6))*Sin[c
 + d*x])/d^8
```

### 3.87.3 Rubi [A] (verified)

Time = 0.55 (sec) , antiderivative size = 235, normalized size of antiderivative = 1.00, number of steps used = 2, number of rules used = 2, $\frac{\text{number of rules}}{\text{integrand size}}$ = 0.118, Rules used = {3820, 2009}

Below are the steps used by Rubi to obtain the solution. The rule number used for the transformation is given above next to the arrow. The rules definitions used are listed below.

$$\int x\left(a+bx^3\right)^2\sin(c+dx)\,dx$$
$$\Big\downarrow \text{3820}$$
$$\int \left(a^2x\sin(c+dx)+2abx^4\sin(c+dx)+b^2x^7\sin(c+dx)\right)dx$$
$$\Big\downarrow \text{2009}$$
$$\frac{a^2\sin(c+dx)}{d^2}-\frac{a^2x\cos(c+dx)}{d}-\frac{48ab\cos(c+dx)}{d^5}-\frac{48abx\sin(c+dx)}{d^4}+\frac{24abx^2\cos(c+dx)}{d^3}+\frac{8abx^3\sin(c+dx)}{d^2}-\frac{2abx^4\cos(c+dx)}{d}-\frac{5040b^2\sin(c+dx)}{d^8}+\frac{5040b^2x\cos(c+dx)}{d^7}+\frac{2520b^2x^2\sin(c+dx)}{d^6}-\frac{840b^2x^3\cos(c+dx)}{d^5}-\frac{210b^2x^4\sin(c+dx)}{d^4}+\frac{42b^2x^5\cos(c+dx)}{d^3}+\frac{7b^2x^6\sin(c+dx)}{d^2}-\frac{b^2x^7\cos(c+dx)}{d}$$

input
```
Int[x*(a + b*x^3)^2*Sin[c + d*x],x]
```

output
```
(-48*a*b*Cos[c + d*x])/d^5 + (5040*b^2*x*Cos[c + d*x])/d^7 - (a^2*x*Cos[c
+ d*x])/d + (24*a*b*x^2*Cos[c + d*x])/d^3 - (840*b^2*x^3*Cos[c + d*x])/d^5
 - (2*a*b*x^4*Cos[c + d*x])/d + (42*b^2*x^5*Cos[c + d*x])/d^3 - (b^2*x^7*C
os[c + d*x])/d - (5040*b^2*Sin[c + d*x])/d^8 + (a^2*Sin[c + d*x])/d^2 - (4
8*a*b*x*Sin[c + d*x])/d^4 + (2520*b^2*x^2*Sin[c + d*x])/d^6 + (8*a*b*x^3*S
in[c + d*x])/d^2 - (210*b^2*x^4*Sin[c + d*x])/d^4 + (7*b^2*x^6*Sin[c + d*x
])/d^2
```

#### 3.87.3.1 Defintions of rubi rules used

rule 2009
```
Int[u_, x_Symbol] :> Simp[IntSum[u, x], x] /; SumQ[u]
```

rule 3820
```
Int[((e_.)*(x_))^(m_.)*((a_) + (b_.)*(x_)^(n_))^(p_.)*Sin[(c_.) + (d_.)*(x_
)], x_Symbol] :> Int[ExpandIntegrand[Sin[c + d*x], (e*x)^m*(a + b*x^n)^p, x
], x] /; FreeQ[{a, b, c, d, e, m, n}, x] && IGtQ[p, 0]
```

### 3.87.4 Maple [A] (verified)

Time = 0.32 (sec) , antiderivative size = 161, normalized size of antiderivative = 0.69

| method | result |
|---|---|
| risch | $-\frac{(b^2d^6x^7+2ab\,d^6x^4-42b^2d^4x^5+a^2d^6x-24ab\,d^4x^2+840b^2d^2x^3+48ab\,d^2-5040b^2x)\cos(dx+c)}{d^7}+\frac{(7b^2x^6d^6+8ab\,d^6x \cdots}{}$ |
| parallelrisch | $\frac{\left(x(b\,x^3+a)^2d^6+(-42b^2x^5-24ab\,x^2)d^4+(840b^2x^3+96ab)d^2-5040b^2x\right)d\left(\tan^2\left(\frac{dx}{2}+\frac{c}{2}\right)\right)+\left((14b^2x^6+16ab\,x^3+2a^2)d^6 \cdots\right.}{d^8\left(1+\mathrm{t} \cdots\right.}$ |
| norman | $\frac{96ab\left(\tan^2\left(\frac{dx}{2}+\frac{c}{2}\right)\right)}{d^5}+\frac{b^2x^7\left(\tan^2\left(\frac{dx}{2}+\frac{c}{2}\right)\right)}{d}+\frac{\left(a^2d^6-5040b^2\right)x\left(\tan^2\left(\frac{dx}{2}+\frac{c}{2}\right)\right)}{d^7}-\frac{840b^2x^3}{d^5}+\frac{42b^2x^5}{d^3}-\frac{b^2x^7}{d}-\frac{\left(a^2d^6-5040b^2\right)x}{d^7} \cdots$ |
| meijerg | $\frac{128b^2\sqrt{\pi}\,\sin(c)\left(\frac{315}{8\sqrt{\pi}}-\frac{\left(-\frac{7}{16}d^6x^6+\frac{105}{8}d^4x^4-\frac{315}{2}d^2x^2+315\right)\cos(dx)}{8\sqrt{\pi}}-\frac{xd\left(-\frac{1}{16}d^6x^6+\frac{21}{8}d^4x^4-\frac{105}{2}d^2x^2+315\right)\sin(dx)}{8\sqrt{\pi}}\right)}{d^8}+ \cdots$ |
| parts | $-\frac{b^2x^7\cos(dx+c)}{d}-\frac{2ab\,x^4\cos(dx+c)}{d}-\frac{a^2x\cos(dx+c)}{d}+\frac{a^2\sin(dx+c)-\frac{8ab\,c^3\sin(dx+c)}{d^3}+\frac{24ab\,c^2(\cos(dx+c)+(dx+c \cdots}{d^3}}{}$ |
| derivativedivides | $\frac{a^2c\cos(dx+c)+a^2(\sin(dx+c)-\cos(dx+c)(dx+c))-\frac{2ab\,c^4\cos(dx+c)}{d^3}-\frac{8ab\,c^3(\sin(dx+c)-\cos(dx+c)(dx+c))}{d^3}+\frac{12ab\,c^2\left(-(dx+ \cdots\right.}{d^3}}{}$ |
| default | $\frac{a^2c\cos(dx+c)+a^2(\sin(dx+c)-\cos(dx+c)(dx+c))-\frac{2ab\,c^4\cos(dx+c)}{d^3}-\frac{8ab\,c^3(\sin(dx+c)-\cos(dx+c)(dx+c))}{d^3}+\frac{12ab\,c^2\left(-(dx+ \cdots\right.}{d^3}}{}$ |

input
```
int(x*(b*x^3+a)^2*sin(d*x+c),x,method=_RETURNVERBOSE)
```

output
```
-1/d^7*(b^2*d^6*x^7+2*a*b*d^6*x^4-42*b^2*d^4*x^5+a^2*d^6*x-24*a*b*d^4*x^2+
840*b^2*d^2*x^3+48*a*b*d^2-5040*b^2*x)*cos(d*x+c)+(7*b^2*d^6*x^6+8*a*b*d^6
*x^3-210*b^2*d^4*x^4+a^2*d^6-48*a*b*d^4*x+2520*b^2*d^2*x^2-5040*b^2)/d^8*s
in(d*x+c)
```

## 3.87.5 Fricas [A] (verification not implemented)

Time = 0.30 (sec) , antiderivative size = 161, normalized size of antiderivative = 0.69

$$\int x\left(a+bx^3\right)^2\sin(c+dx)\,dx =$$
$$-\frac{(b^2d^7x^7+2\,abd^7x^4-42\,b^2d^5x^5-24\,abd^5x^2+840\,b^2d^3x^3+48\,abd^3+(a^2d^7-5040\,b^2d)x)\cos(dx+c) \cdots}{d^8}$$

input
```
integrate(x*(b*x^3+a)^2*sin(d*x+c),x, algorithm="fricas")
```

output
```
-((b^2*d^7*x^7 + 2*a*b*d^7*x^4 - 42*b^2*d^5*x^5 - 24*a*b*d^5*x^2 + 840*b^2
*d^3*x^3 + 48*a*b*d^3 + (a^2*d^7 - 5040*b^2*d)*x)*cos(d*x + c) - (7*b^2*d^
6*x^6 + 8*a*b*d^6*x^3 - 210*b^2*d^4*x^4 + a^2*d^6 - 48*a*b*d^4*x + 2520*b^
2*d^2*x^2 - 5040*b^2)*sin(d*x + c))/d^8
```

### 3.87.6 Sympy [A] (verification not implemented)

Time = 0.80 (sec) , antiderivative size = 284, normalized size of antiderivative = 1.21

$$\int x\left(a+bx^3\right)^2\sin(c+dx)\,dx$$
$$=\begin{cases} -\frac{a^2x\cos(c+dx)}{d}+\frac{a^2\sin(c+dx)}{d^2}-\frac{2abx^4\cos(c+dx)}{d}+\frac{8abx^3\sin(c+dx)}{d^2}+\frac{24abx^2\cos(c+dx)}{d^3}-\frac{48abx\sin(c+dx)}{d^4}-\frac{48ab\cos(c+dx)}{d^5} \\ \left(\frac{a^2x^2}{2}+\frac{2abx^5}{5}+\frac{b^2x^8}{8}\right)\sin(c) \end{cases}$$

input
```
integrate(x*(b*x**3+a)**2*sin(d*x+c),x)
```

output
```
Piecewise((-a**2*x*cos(c + d*x)/d + a**2*sin(c + d*x)/d**2 - 2*a*b*x**4*co
s(c + d*x)/d + 8*a*b*x**3*sin(c + d*x)/d**2 + 24*a*b*x**2*cos(c + d*x)/d**
3 - 48*a*b*x*sin(c + d*x)/d**4 - 48*a*b*cos(c + d*x)/d**5 - b**2*x**7*cos(
c + d*x)/d + 7*b**2*x**6*sin(c + d*x)/d**2 + 42*b**2*x**5*cos(c + d*x)/d**
3 - 210*b**2*x**4*sin(c + d*x)/d**4 - 840*b**2*x**3*cos(c + d*x)/d**5 + 25
20*b**2*x**2*sin(c + d*x)/d**6 + 5040*b**2*x*cos(c + d*x)/d**7 - 5040*b**2
*sin(c + d*x)/d**8, Ne(d, 0)), ((a**2*x**2/2 + 2*a*b*x**5/5 + b**2*x**8/8)
*sin(c), True))
```

### 3.87.7 Maxima [B] (verification not implemented)

Leaf count of result is larger than twice the leaf count of optimal. 662 vs. $2(235) = 470$.

Time = 0.24 (sec) , antiderivative size = 662, normalized size of antiderivative = 2.82

$$\int x\left(a+bx^3\right)^2\sin(c+dx)\,dx$$
$$=\frac{a^2c\cos(dx+c)+\frac{b^2c^7\cos(dx+c)}{d^6}-\frac{2abc^4\cos(dx+c)}{d^3}-((dx+c)\cos(dx+c)-\sin(dx+c))a^2-\frac{7((dx+c)\cos(dx+c}{d^6}}{}$$

input
```
integrate(x*(b*x^3+a)^2*sin(d*x+c),x, algorithm="maxima")
```

output
```
(a^2*c*cos(d*x + c) + b^2*c^7*cos(d*x + c)/d^6 - 2*a*b*c^4*cos(d*x + c)/d^
3 - ((d*x + c)*cos(d*x + c) - sin(d*x + c))*a^2 - 7*((d*x + c)*cos(d*x + c
) - sin(d*x + c))*b^2*c^6/d^6 + 8*((d*x + c)*cos(d*x + c) - sin(d*x + c))*
a*b*c^3/d^3 + 21*(((d*x + c)^2 - 2)*cos(d*x + c) - 2*(d*x + c)*sin(d*x + c
))*b^2*c^5/d^6 - 12*(((d*x + c)^2 - 2)*cos(d*x + c) - 2*(d*x + c)*sin(d*x
+ c))*a*b*c^2/d^3 - 35*(((d*x + c)^3 - 6*d*x - 6*c)*cos(d*x + c) - 3*((d*x
 + c)^2 - 2)*sin(d*x + c))*b^2*c^4/d^6 + 8*(((d*x + c)^3 - 6*d*x - 6*c)*co
s(d*x + c) - 3*((d*x + c)^2 - 2)*sin(d*x + c))*a*b*c/d^3 + 35*(((d*x + c)^
4 - 12*(d*x + c)^2 + 24)*cos(d*x + c) - 4*((d*x + c)^3 - 6*d*x - 6*c)*sin(
d*x + c))*b^2*c^3/d^6 - 2*(((d*x + c)^4 - 12*(d*x + c)^2 + 24)*cos(d*x + c
) - 4*((d*x + c)^3 - 6*d*x - 6*c)*sin(d*x + c))*a*b/d^3 - 21*(((d*x + c)^5
 - 20*(d*x + c)^3 + 120*d*x + 120*c)*cos(d*x + c) - 5*((d*x + c)^4 - 12*(d
*x + c)^2 + 24)*sin(d*x + c))*b^2*c^2/d^6 + 7*(((d*x + c)^6 - 30*(d*x + c)
^4 + 360*(d*x + c)^2 - 720)*cos(d*x + c) - 6*((d*x + c)^5 - 20*(d*x + c)^3
 + 120*d*x + 120*c)*sin(d*x + c))*b^2*c/d^6 - (((d*x + c)^7 - 42*(d*x + c)
^5 + 840*(d*x + c)^3 - 5040*d*x - 5040*c)*cos(d*x + c) - 7*((d*x + c)^6 -
30*(d*x + c)^4 + 360*(d*x + c)^2 - 720)*sin(d*x + c))*b^2/d^6)/d^2
```

### 3.87.8 Giac [A] (verification not implemented)

Time = 0.31 (sec) , antiderivative size = 161, normalized size of antiderivative = 0.69

$$\int x(a+bx^3)^2 \sin(c+dx)\,dx = -\frac{(b^2d^7x^7+2\,abd^7x^4-42\,b^2d^5x^5+a^2d^7x-24\,abd^5x^2+840\,b^2d^3x^3+48\,abd^3-5040\,b^2dx)\cos{(dx+c)}}{d^8} + \frac{(7\,b^2d^6x^6+8\,abd^6x^3-210\,b^2d^4x^4+a^2d^6-48\,abd^4x+2520\,b^2d^2x^2-5040\,b^2)\sin{(dx+c)}}{d^8}$$

input
```
integrate(x*(b*x^3+a)^2*sin(d*x+c),x, algorithm="giac")
```

output
```
-(b^2*d^7*x^7 + 2*a*b*d^7*x^4 - 42*b^2*d^5*x^5 + a^2*d^7*x - 24*a*b*d^5*x^
2 + 840*b^2*d^3*x^3 + 48*a*b*d^3 - 5040*b^2*d*x)*cos(d*x + c)/d^8 + (7*b^2
*d^6*x^6 + 8*a*b*d^6*x^3 - 210*b^2*d^4*x^4 + a^2*d^6 - 48*a*b*d^4*x + 2520
*b^2*d^2*x^2 - 5040*b^2)*sin(d*x + c)/d^8
```

### 3.87.9 Mupad [B] (verification not implemented)

Time = 6.45 (sec) , antiderivative size = 225, normalized size of antiderivative = 0.96

$$\int x(a+bx^3)^2\sin(c+dx)\,dx$$
$$= \frac{42\,b^2\,x^5\,\cos(c+d\,x)+24\,a\,b\,x^2\,\cos(c+d\,x)}{d^3} - \frac{b^2\,x^7\,\cos(c+d\,x)+a^2\,x\,\cos(c+d\,x)+2\,a\,b\,x^4\,\cos(c+d\,x)}{d} - \frac{840\,b^2\,x^3\,\cos(c+d\,x)+48\,a\,b\,\cos(c+d\,x)}{d^5} + \frac{a^2\,\sin(c+d\,x)+7\,b^2\,x^6\,\sin(c+d\,x)+8\,a\,b\,x^3\,\sin(c+d\,x)}{d^2} - \frac{210\,b^2\,x^4\,\sin(c+d\,x)+48\,a\,b\,x\,\sin(c+d\,x)}{d^4} - \frac{5040\,b^2\,\sin(c+d\,x)}{d^8} + \frac{2520\,b^2\,x^2\,\sin(c+d\,x)}{d^6} + \frac{5040\,b^2\,x\,\cos(c+d\,x)}{d^7}$$

input
```
int(x*sin(c + d*x)*(a + b*x^3)^2,x)
```

output
```
(42*b^2*x^5*cos(c + d*x) + 24*a*b*x^2*cos(c + d*x))/d^3 - (b^2*x^7*cos(c +
 d*x) + a^2*x*cos(c + d*x) + 2*a*b*x^4*cos(c + d*x))/d - (840*b^2*x^3*cos(
c + d*x) + 48*a*b*cos(c + d*x))/d^5 + (a^2*sin(c + d*x) + 7*b^2*x^6*sin(c
+ d*x) + 8*a*b*x^3*sin(c + d*x))/d^2 - (210*b^2*x^4*sin(c + d*x) + 48*a*b*
x*sin(c + d*x))/d^4 - (5040*b^2*sin(c + d*x))/d^8 + (2520*b^2*x^2*sin(c +
d*x))/d^6 + (5040*b^2*x*cos(c + d*x))/d^7
```

# 3.88 $\int (a+bx^3)^2 \sin(c+dx)\,dx$



## 3.88.1 Optimal result

Integrand size = 16, antiderivative size = 188

$$\int (a+bx^3)^2 \sin(c+dx)\,dx = \frac{720b^2\cos(c+dx)}{d^7} - \frac{a^2\cos(c+dx)}{d} + \frac{12abx\cos(c+dx)}{d^3} - \frac{360b^2x^2\cos(c+dx)}{d^5} - \frac{2abx^3\cos(c+dx)}{d} + \frac{30b^2x^4\cos(c+dx)}{d^3} - \frac{b^2x^6\cos(c+dx)}{d} - \frac{12ab\sin(c+dx)}{d^4} + \frac{720b^2x\sin(c+dx)}{d^6} + \frac{6abx^2\sin(c+dx)}{d^2} - \frac{120b^2x^3\sin(c+dx)}{d^4} + \frac{6b^2x^5\sin(c+dx)}{d^2}$$

output
```
720*b^2*cos(d*x+c)/d^7-a^2*cos(d*x+c)/d+12*a*b*x*cos(d*x+c)/d^3-360*b^2*x^
2*cos(d*x+c)/d^5-2*a*b*x^3*cos(d*x+c)/d+30*b^2*x^4*cos(d*x+c)/d^3-b^2*x^6*
cos(d*x+c)/d-12*a*b*sin(d*x+c)/d^4+720*b^2*x*sin(d*x+c)/d^6+6*a*b*x^2*sin(
d*x+c)/d^2-120*b^2*x^3*sin(d*x+c)/d^4+6*b^2*x^5*sin(d*x+c)/d^2
```

### 3.88.2 Mathematica [A] (verified)

Time = 0.20 (sec) , antiderivative size = 112, normalized size of antiderivative = 0.60

$$\int (a+bx^3)^2 \sin(c+dx)\,dx = \frac{-((a^2d^6+2abd^4x(-6+d^2x^2)+b^2(-720+360d^2x^2-30d^4x^4+d^6x^6))\cos(c+dx))+6bd(ad^2(-2+d^2x^2)}{d^7}$$

input
```
Integrate[(a + b*x^3)^2*Sin[c + d*x],x]
```

output
```
(-((a^2*d^6 + 2*a*b*d^4*x*(-6 + d^2*x^2) + b^2*(-720 + 360*d^2*x^2 - 30*d^
4*x^4 + d^6*x^6))*Cos[c + d*x]) + 6*b*d*(a*d^2*(-2 + d^2*x^2) + b*x*(120 -
 20*d^2*x^2 + d^4*x^4))*Sin[c + d*x])/d^7
```

### 3.88.3 Rubi [A] (verified)

Time = 0.46 (sec) , antiderivative size = 188, normalized size of antiderivative = 1.00, number of steps used = 2, number of rules used = 2, $\frac{\text{number of rules}}{\text{integrand size}} = 0.125$, Rules used = {3810, 2009}

Below are the steps used by Rubi to obtain the solution. The rule number used for the transformation is given above next to the arrow. The rules definitions used are listed below.

$$\int (a+bx^3)^2 \sin(c+dx)\,dx$$

$$\Big\downarrow \ 3810$$

$$\int \left(a^2\sin(c+dx)+2abx^3\sin(c+dx)+b^2x^6\sin(c+dx)\right)dx$$

$$\Big\downarrow \ 2009$$

$$-\frac{a^2\cos(c+dx)}{d}-\frac{12ab\sin(c+dx)}{d^4}+\frac{12abx\cos(c+dx)}{d^3}+\frac{6abx^2\sin(c+dx)}{d^2}-\frac{2abx^3\cos(c+dx)}{d}+\frac{720b^2\cos(c+dx)}{d^7}+\frac{720b^2x\sin(c+dx)}{d^6}-\frac{360b^2x^2\cos(c+dx)}{d^5}-\frac{120b^2x^3\sin(c+dx)}{d^4}+\frac{30b^2x^4\cos(c+dx)}{d^3}+\frac{6b^2x^5\sin(c+dx)}{d^2}-\frac{b^2x^6\cos(c+dx)}{d}$$

input
```
Int[(a + b*x^3)^2*Sin[c + d*x],x]
```

output
```
(720*b^2*Cos[c + d*x])/d^7 - (a^2*Cos[c + d*x])/d + (12*a*b*x*Cos[c + d*x]
)/d^3 - (360*b^2*x^2*Cos[c + d*x])/d^5 - (2*a*b*x^3*Cos[c + d*x])/d + (30*
b^2*x^4*Cos[c + d*x])/d^3 - (b^2*x^6*Cos[c + d*x])/d - (12*a*b*Sin[c + d*x
])/d^4 + (720*b^2*x*Sin[c + d*x])/d^6 + (6*a*b*x^2*Sin[c + d*x])/d^2 - (12
0*b^2*x^3*Sin[c + d*x])/d^4 + (6*b^2*x^5*Sin[c + d*x])/d^2
```

### 3.88.3.1 Defintions of rubi rules used

rule 2009
```
Int[u_, x_Symbol] :> Simp[IntSum[u, x], x] /; SumQ[u]
```

rule 3810
```
Int[((a_) + (b_.)*(x_)^(n_))^(p_.)*Sin[(c_.) + (d_.)*(x_)], x_Symbol] :> In
t[ExpandIntegrand[Sin[c + d*x], (a + b*x^n)^p, x], x] /; FreeQ[{a, b, c, d,
 n}, x] && IGtQ[p, 0]
```

## 3.88.4 Maple [A] (verified)

Time = 0.28 (sec) , antiderivative size = 124, normalized size of antiderivative = 0.66

| method | result |
|---|---|
| risch | $-\frac{\left(b^2x^6d^6+2ab\,d^6x^3-30b^2x^4d^4+a^2d^6-12ab\,d^4x+360d^2x^2b^2-720b^2\right)\cos(dx+c)}{d^7}+\frac{6b\left(b\,d^4x^5+a\,d^4x^2-20b\,d^2x^3-2a\cdots\right.}{d^6}$ |
| parallelrisch | $\frac{2\left(x^2\left(\frac{b\,x^3}{2}+a\right)d^4+\left(-15b\,x^3-6a\right)d^2+180bx\right)x\,d^2b\left(\tan^2\left(\frac{dx}{2}+\frac{c}{2}\right)\right)+12db\left(x^2\left(b\,x^3+a\right)d^4+\left(-20b\,x^3-2a\right)d^2+120bx\right)\tan\cdots}{d^7\left(1+\tan^2\left(\frac{dx}{2}+\frac{c}{2}\right)\right)}$ |
| norman | $\frac{b^2x^6\left(\tan^2\left(\frac{dx}{2}+\frac{c}{2}\right)\right)}{d}-\frac{2a^2d^6-1440b^2}{d^7}-\frac{360b^2x^2}{d^5}+\frac{30b^2x^4}{d^3}-\frac{b^2x^6}{d}-\frac{24ab\tan\left(\frac{dx}{2}+\frac{c}{2}\right)}{d^4}+\frac{1440b^2x\tan\left(\frac{dx}{2}+\frac{c}{2}\right)}{d^6}+\frac{360b^2x^2\left(\tan^2\left(\frac{d\cdots}{}\right)\right)}{d^5}$ |
| meijerg | $\frac{64b^2\sqrt{\pi}\,\sin(c)\left(\frac{x\left(d^2\right)^{\frac{7}{2}}\left(\frac{21}{8}d^4x^4-\frac{105}{2}d^2x^2+315\right)\cos(dx)}{28\sqrt{\pi}\,d^6}-\frac{\left(d^2\right)^{\frac{7}{2}}\left(-\frac{7}{16}d^6x^6+\frac{105}{8}d^4x^4-\frac{315}{2}d^2x^2+315\right)\sin(dx)}{28\sqrt{\pi}\,d^7}\right)}{d^6\sqrt{d^2}}+\frac{64b^2\sqrt{\cdots}}{\cdots}$ |
| parts | $-\frac{b^2x^6\cos(dx+c)}{d}-\frac{2ab\,x^3\cos(dx+c)}{d}-\frac{a^2\cos(dx+c)}{d}+\frac{6b\left(a\,c^2\sin(dx+c)-2ac(\cos(dx+c)+(dx+c)\sin(dx+c))+\cdots\right.}{\cdots}$ |
| derivativedivides | $\frac{-a^2\cos(dx+c)+\frac{2ab\,c^3\cos(dx+c)}{d^3}+\frac{6ab\,c^2(\sin(dx+c)-\cos(dx+c)(dx+c))}{d^3}-\frac{6abc\left(-(dx+c)^2\cos(dx+c)+2\cos(dx+c)+2(dx+c)\sin(d\cdots\right.}{d^3}}{\cdots}$ |
| default | $\frac{-a^2\cos(dx+c)+\frac{2ab\,c^3\cos(dx+c)}{d^3}+\frac{6ab\,c^2(\sin(dx+c)-\cos(dx+c)(dx+c))}{d^3}-\frac{6abc\left(-(dx+c)^2\cos(dx+c)+2\cos(dx+c)+2(dx+c)\sin(d\cdots\right.}{d^3}}{\cdots}$ |

input
```
int((b*x^3+a)^2*sin(d*x+c),x,method=_RETURNVERBOSE)
```

output
```
-(b^2*d^6*x^6+2*a*b*d^6*x^3-30*b^2*d^4*x^4+a^2*d^6-12*a*b*d^4*x+360*b^2*d^
2*x^2-720*b^2)/d^7*cos(d*x+c)+6*b/d^6*(b*d^4*x^5+a*d^4*x^2-20*b*d^2*x^3-2*
a*d^2+120*b*x)*sin(d*x+c)
```

### 3.88.5 Fricas [A] (verification not implemented)

Time = 0.29 (sec) , antiderivative size = 129, normalized size of antiderivative = 0.69

$$\int (a+bx^3)^2 \sin(c+dx)\,dx = -\frac{(b^2d^6x^6 + 2\,abd^6x^3 - 30\,b^2d^4x^4 + a^2d^6 - 12\,abd^4x + 360\,b^2d^2x^2 - 720\,b^2)\cos(dx+c) - 6\,(b^2d^5x^5 + abc}{d^7}$$

input
```
integrate((b*x^3+a)^2*sin(d*x+c),x, algorithm="fricas")
```

output
```
-((b^2*d^6*x^6 + 2*a*b*d^6*x^3 - 30*b^2*d^4*x^4 + a^2*d^6 - 12*a*b*d^4*x +
 360*b^2*d^2*x^2 - 720*b^2)*cos(d*x + c) - 6*(b^2*d^5*x^5 + a*b*d^5*x^2 -
20*b^2*d^3*x^3 - 2*a*b*d^3 + 120*b^2*d*x)*sin(d*x + c))/d^7
```

### 3.88.6 Sympy [A] (verification not implemented)

Time = 0.57 (sec) , antiderivative size = 226, normalized size of antiderivative = 1.20

$$\int (a+bx^3)^2 \sin(c+dx)\,dx = \begin{cases} -\frac{a^2\cos(c+dx)}{d} - \frac{2abx^3\cos(c+dx)}{d} + \frac{6abx^2\sin(c+dx)}{d^2} + \frac{12abx\cos(c+dx)}{d^3} - \frac{12ab\sin(c+dx)}{d^4} - \frac{b^2x^6\cos(c+dx)}{d} + \frac{6b^2x^5\sin(c+dx}{d^2} \\ \left(a^2x + \frac{abx^4}{2} + \frac{b^2x^7}{7}\right)\sin(c) \end{cases}$$

input
```
integrate((b*x**3+a)**2*sin(d*x+c),x)
```

output
```
Piecewise((-a**2*cos(c + d*x)/d - 2*a*b*x**3*cos(c + d*x)/d + 6*a*b*x**2*s
in(c + d*x)/d**2 + 12*a*b*x*cos(c + d*x)/d**3 - 12*a*b*sin(c + d*x)/d**4 -
 b**2*x**6*cos(c + d*x)/d + 6*b**2*x**5*sin(c + d*x)/d**2 + 30*b**2*x**4*c
os(c + d*x)/d**3 - 120*b**2*x**3*sin(c + d*x)/d**4 - 360*b**2*x**2*cos(c +
 d*x)/d**5 + 720*b**2*x*sin(c + d*x)/d**6 + 720*b**2*cos(c + d*x)/d**7, Ne
(d, 0)), ((a**2*x + a*b*x**4/2 + b**2*x**7/7)*sin(c), True))
```

### 3.88.7 Maxima [B] (verification not implemented)

Leaf count of result is larger than twice the leaf count of optimal. 489 vs. $2(188) = 376$.

Time = 0.23 (sec) , antiderivative size = 489, normalized size of antiderivative = 2.60

$$\int (a+bx^3)^2 \sin(c+dx)\,dx =$$

$$-\frac{a^2\cos(dx+c) + \frac{b^2c^6\cos(dx+c)}{d^6} - \frac{2\,abc^3\cos(dx+c)}{d^3} - \frac{6\,((dx+c)\cos(dx+c)-\sin(dx+c))b^2c^5}{d^6} + \frac{6\,((dx+c)\cos(dx+c)-\sin(dx+c))}{d^3}}{}$$

input
```
integrate((b*x^3+a)^2*sin(d*x+c),x, algorithm="maxima")
```

output
```
-(a^2*cos(d*x + c) + b^2*c^6*cos(d*x + c)/d^6 - 2*a*b*c^3*cos(d*x + c)/d^3
 - 6*((d*x + c)*cos(d*x + c) - sin(d*x + c))*b^2*c^5/d^6 + 6*((d*x + c)*co
s(d*x + c) - sin(d*x + c))*a*b*c^2/d^3 + 15*(((d*x + c)^2 - 2)*cos(d*x + c
) - 2*(d*x + c)*sin(d*x + c))*b^2*c^4/d^6 - 6*(((d*x + c)^2 - 2)*cos(d*x +
 c) - 2*(d*x + c)*sin(d*x + c))*a*b*c/d^3 - 20*(((d*x + c)^3 - 6*d*x - 6*c
)*cos(d*x + c) - 3*((d*x + c)^2 - 2)*sin(d*x + c))*b^2*c^3/d^6 + 2*(((d*x
+ c)^3 - 6*d*x - 6*c)*cos(d*x + c) - 3*((d*x + c)^2 - 2)*sin(d*x + c))*a*b
/d^3 + 15*(((d*x + c)^4 - 12*(d*x + c)^2 + 24)*cos(d*x + c) - 4*((d*x + c)
^3 - 6*d*x - 6*c)*sin(d*x + c))*b^2*c^2/d^6 - 6*(((d*x + c)^5 - 20*(d*x +
c)^3 + 120*d*x + 120*c)*cos(d*x + c) - 5*((d*x + c)^4 - 12*(d*x + c)^2 + 2
4)*sin(d*x + c))*b^2*c/d^6 + (((d*x + c)^6 - 30*(d*x + c)^4 + 360*(d*x + c
)^2 - 720)*cos(d*x + c) - 6*((d*x + c)^5 - 20*(d*x + c)^3 + 120*d*x + 120*
c)*sin(d*x + c))*b^2/d^6)/d
```

### 3.88.8 Giac [A] (verification not implemented)

Time = 0.32 (sec) , antiderivative size = 131, normalized size of antiderivative = 0.70

$$\int (a+bx^3)^2 \sin(c+dx)\,dx$$
$$= -\frac{(b^2d^6x^6 + 2\,abd^6x^3 - 30\,b^2d^4x^4 + a^2d^6 - 12\,abd^4x + 360\,b^2d^2x^2 - 720\,b^2)\cos(dx+c)}{d^7}$$
$$+ \frac{6\,(b^2d^5x^5 + abd^5x^2 - 20\,b^2d^3x^3 - 2\,abd^3 + 120\,b^2dx)\sin(dx+c)}{d^7}$$

input
```
integrate((b*x^3+a)^2*sin(d*x+c),x, algorithm="giac")
```

output
```
-(b^2*d^6*x^6 + 2*a*b*d^6*x^3 - 30*b^2*d^4*x^4 + a^2*d^6 - 12*a*b*d^4*x +
360*b^2*d^2*x^2 - 720*b^2)*cos(d*x + c)/d^7 + 6*(b^2*d^5*x^5 + a*b*d^5*x^2
 - 20*b^2*d^3*x^3 - 2*a*b*d^3 + 120*b^2*d*x)*sin(d*x + c)/d^7
```

### 3.88.9 Mupad [B] (verification not implemented)

Time = 0.77 (sec) , antiderivative size = 184, normalized size of antiderivative = 0.98

$$\int (a+bx^3)^2 \sin(c+dx)\,dx = \frac{\cos(c+d\,x)\,\left(720\,b^2-a^2\,d^6\right)}{d^7} - \frac{b^2\,x^6\,\cos(c+d\,x)}{d} + \frac{30\,b^2\,x^4\,\cos(c+d\,x)}{d^3} - \frac{360\,b^2\,x^2\,\cos(c+d\,x)}{d^5} + \frac{6\,b^2\,x^5\,\sin(c+d\,x)}{d^2} - \frac{120\,b^2\,x^3\,\sin(c+d\,x)}{d^4} - \frac{12\,a\,b\,\sin(c+d\,x)}{d^4} + \frac{720\,b^2\,x\,\sin(c+d\,x)}{d^6} - \frac{2\,a\,b\,x^3\,\cos(c+d\,x)}{d} + \frac{6\,a\,b\,x^2\,\sin(c+d\,x)}{d^2} + \frac{12\,a\,b\,x\,\cos(c+d\,x)}{d^3}$$

input
```
int(sin(c + d*x)*(a + b*x^3)^2,x)
```

output
```
(cos(c + d*x)*(720*b^2 - a^2*d^6))/d^7 - (b^2*x^6*cos(c + d*x))/d + (30*b^
2*x^4*cos(c + d*x))/d^3 - (360*b^2*x^2*cos(c + d*x))/d^5 + (6*b^2*x^5*sin(
c + d*x))/d^2 - (120*b^2*x^3*sin(c + d*x))/d^4 - (12*a*b*sin(c + d*x))/d^4
 + (720*b^2*x*sin(c + d*x))/d^6 - (2*a*b*x^3*cos(c + d*x))/d + (6*a*b*x^2*
sin(c + d*x))/d^2 + (12*a*b*x*cos(c + d*x))/d^3
```

# 3.89 $\int \frac{(a+bx^3)^2 \sin(c+dx)}{x} \, dx$



## 3.89.1 Optimal result

Integrand size = 19, antiderivative size = 161

$$\begin{aligned}\int \frac{(a+bx^3)^2 \sin(c+dx)}{x} \, dx = {} & \frac{4ab\cos(c+dx)}{d^3} - \frac{120b^2x\cos(c+dx)}{d^5} - \frac{2abx^2\cos(c+dx)}{d} \\ & + \frac{20b^2x^3\cos(c+dx)}{d^3} - \frac{b^2x^5\cos(c+dx)}{d} \\ & + a^2 \operatorname{CosIntegral}(dx)\sin(c) + \frac{120b^2\sin(c+dx)}{d^6} \\ & + \frac{4abx\sin(c+dx)}{d^2} - \frac{60b^2x^2\sin(c+dx)}{d^4} \\ & + \frac{5b^2x^4\sin(c+dx)}{d^2} + a^2\cos(c)\operatorname{Si}(dx)\end{aligned}$$

output
```
4*a*b*cos(d*x+c)/d^3-120*b^2*x*cos(d*x+c)/d^5-2*a*b*x^2*cos(d*x+c)/d+20*b^
2*x^3*cos(d*x+c)/d^3-b^2*x^5*cos(d*x+c)/d+a^2*cos(c)*Si(d*x)+a^2*Ci(d*x)*s
in(c)+120*b^2*sin(d*x+c)/d^6+4*a*b*x*sin(d*x+c)/d^2-60*b^2*x^2*sin(d*x+c)/
d^4+5*b^2*x^4*sin(d*x+c)/d^2
```

### 3.89.2 Mathematica [A] (verified)

Time = 0.35 (sec) , antiderivative size = 108, normalized size of antiderivative = 0.67

$$\int \frac{(a+bx^3)^2 \sin(c+dx)}{x} \, dx = -\frac{b(2ad^2(-2+d^2x^2)+bx(120-20d^2x^2+d^4x^4))\cos(c+dx)}{d^5} + a^2 \operatorname{CosIntegral}(dx)\sin(c) + \frac{b(4ad^4x+5b(24-12d^2x^2+d^4x^4))\sin(c+dx)}{d^6} + a^2\cos(c)\operatorname{Si}(dx)$$

input
```
Integrate[((a + b*x^3)^2*Sin[c + d*x])/x,x]
```

output
```
-((b*(2*a*d^2*(-2 + d^2*x^2) + b*x*(120 - 20*d^2*x^2 + d^4*x^4))*Cos[c + d
*x])/d^5) + a^2*CosIntegral[d*x]*Sin[c] + (b*(4*a*d^4*x + 5*b*(24 - 12*d^2
*x^2 + d^4*x^4))*Sin[c + d*x])/d^6 + a^2*Cos[c]*SinIntegral[d*x]
```

### 3.89.3 Rubi [A] (verified)

Time = 0.43 (sec) , antiderivative size = 161, normalized size of antiderivative = 1.00, number of steps used = 2, number of rules used = 2, $\frac{\text{number of rules}}{\text{integrand size}}$ = 0.105, Rules used = {3820, 2009}

Below are the steps used by Rubi to obtain the solution. The rule number used for the transformation is given above next to the arrow. The rules definitions used are listed below.

$$\int \frac{(a+bx^3)^2 \sin(c+dx)}{x} \, dx$$

$$\Big\downarrow \ 3820$$

$$\int \left(\frac{a^2\sin(c+dx)}{x}+2abx^2\sin(c+dx)+b^2x^5\sin(c+dx)\right)dx$$

$$\Big\downarrow \ 2009$$

$$a^2\sin(c)\operatorname{CosIntegral}(dx)+a^2\cos(c)\operatorname{Si}(dx)+\frac{4ab\cos(c+dx)}{d^3}+\frac{4abx\sin(c+dx)}{d^2}-\frac{2abx^2\cos(c+dx)}{d}+\frac{120b^2\sin(c+dx)}{d^6}-\frac{120b^2x\cos(c+dx)}{d^5}-\frac{60b^2x^2\sin(c+dx)}{d^4}+\frac{20b^2x^3\cos(c+dx)}{d^3}+\frac{5b^2x^4\sin(c+dx)}{d^2}-\frac{b^2x^5\cos(c+dx)}{d}$$

input
```
Int[((a + b*x^3)^2*Sin[c + d*x])/x,x]
```

output
```
(4*a*b*Cos[c + d*x])/d^3 - (120*b^2*x*Cos[c + d*x])/d^5 - (2*a*b*x^2*Cos[c
 + d*x])/d + (20*b^2*x^3*Cos[c + d*x])/d^3 - (b^2*x^5*Cos[c + d*x])/d + a^
2*CosIntegral[d*x]*Sin[c] + (120*b^2*Sin[c + d*x])/d^6 + (4*a*b*x*Sin[c +
d*x])/d^2 - (60*b^2*x^2*Sin[c + d*x])/d^4 + (5*b^2*x^4*Sin[c + d*x])/d^2 +
 a^2*Cos[c]*SinIntegral[d*x]
```

### 3.89.3.1 Defintions of rubi rules used

rule 2009
```
Int[u_, x_Symbol] :> Simp[IntSum[u, x], x] /; SumQ[u]
```

rule 3820
```
Int[((e_.)*(x_))^(m_.)*((a_) + (b_.)*(x_)^(n_))^(p_.)*Sin[(c_.) + (d_.)*(x_
)], x_Symbol] :> Int[ExpandIntegrand[Sin[c + d*x], (e*x)^m*(a + b*x^n)^p, x
], x] /; FreeQ[{a, b, c, d, e, m, n}, x] && IGtQ[p, 0]
```

## 3.89.4 Maple [C] (verified)

Result contains complex when optimal does not.

Time = 0.43 (sec) , antiderivative size = 178, normalized size of antiderivative = 1.11

| method | result |
|---|---|
| risch | $-\frac{b^2x^5\cos(dx+c)}{d}+\frac{5b^2x^4\sin(dx+c)}{d^2}-\frac{ia^2\mathrm{e}^{-ic}\,\mathrm{Ei}_1(idx)}{2}+\frac{ia^2\mathrm{e}^{ic}\,\mathrm{Ei}_1(-idx)}{2}-\frac{2ab\,x^2\cos(dx+c)}{d}+\frac{20b^2x^3\cos}{d^3}$ |
| meijerg | $\frac{32b^2\sqrt{\pi}\,\sin(c)\left(-\frac{15}{4\sqrt{\pi}}+\frac{\left(\frac{15}{8}d^4x^4-\frac{45}{2}d^2x^2+45\right)\cos(dx)}{12\sqrt{\pi}}+\frac{xd\left(\frac{3}{8}d^4x^4-\frac{15}{2}d^2x^2+45\right)\sin(dx)}{12\sqrt{\pi}}\right)}{d^6}+\frac{32b^2\sqrt{\pi}\,\cos(c)\left(-\frac{xd\left(\frac{7}{8}d^4\right.}{}\right.}{}$ |
| derivativedivides | $a^2(\mathrm{Si}(dx)\cos(c)+\mathrm{Ci}(dx)\sin(c))-\frac{6ab\,c^2\cos(dx+c)}{d^3}-\frac{6abc(c+1)(\sin(dx+c)-\cos(dx+c)(dx+c))}{d^3}+$ |
| default | $a^2(\mathrm{Si}(dx)\cos(c)+\mathrm{Ci}(dx)\sin(c))-\frac{6ab\,c^2\cos(dx+c)}{d^3}-\frac{6abc(c+1)(\sin(dx+c)-\cos(dx+c)(dx+c))}{d^3}+$ |

input
```
int((b*x^3+a)^2*sin(d*x+c)/x,x,method=_RETURNVERBOSE)
```

output
```
-b^2*x^5*cos(d*x+c)/d+5*b^2*x^4*sin(d*x+c)/d^2-1/2*I*a^2*exp(-I*c)*Ei(1,I*
d*x)+1/2*I*a^2*exp(I*c)*Ei(1,-I*d*x)-2*a*b*x^2*cos(d*x+c)/d+20*b^2*x^3*cos
(d*x+c)/d^3+4*a*b*x*sin(d*x+c)/d^2-60*b^2*x^2*sin(d*x+c)/d^4+4*a*b*cos(d*x
+c)/d^3-120*b^2*x*cos(d*x+c)/d^5+120*b^2*sin(d*x+c)/d^6
```

### 3.89.5 Fricas [A] (verification not implemented)

Time = 0.27 (sec) , antiderivative size = 128, normalized size of antiderivative = 0.80

$$\int \frac{(a+bx^3)^2 \sin(c+dx)}{x} \, dx$$
$$= \frac{a^2d^6 \operatorname{Ci}(dx) \sin(c) + a^2d^6 \cos(c) \operatorname{Si}(dx) - (b^2d^5x^5 + 2\,abd^5x^2 - 20\,b^2d^3x^3 - 4\,abd^3 + 120\,b^2dx) \cos(dx +}{d^6}$$

input
```
integrate((b*x^3+a)^2*sin(d*x+c)/x,x, algorithm="fricas")
```

output
```
(a^2*d^6*cos_integral(d*x)*sin(c) + a^2*d^6*cos(c)*sin_integral(d*x) - (b^
2*d^5*x^5 + 2*a*b*d^5*x^2 - 20*b^2*d^3*x^3 - 4*a*b*d^3 + 120*b^2*d*x)*cos(
d*x + c) + (5*b^2*d^4*x^4 + 4*a*b*d^4*x - 60*b^2*d^2*x^2 + 120*b^2)*sin(d*
x + c))/d^6
```

### 3.89.6 Sympy [A] (verification not implemented)

Time = 3.69 (sec) , antiderivative size = 207, normalized size of antiderivative = 1.29

$$\int \frac{(a+bx^3)^2 \sin(c+dx)}{x}\,dx$$

$$= a^2 \sin(c)\operatorname{Ci}(dx) + a^2\cos(c)\operatorname{Si}(dx) + 2abx^2\left(\begin{cases} x\sin(c) & \text{for } d=0 \\ -\frac{\cos(c+dx)}{d} & \text{otherwise}\end{cases}\right) - 4ab\left(\begin{cases} \frac{x^3\sin(c)}{3} & \text{for } d=0 \\ -\frac{\begin{cases} \frac{x\sin(c+dx)}{d} + \frac{\cos(c+dx)}{d^2} & \text{for } d\neq 0 \\ \frac{x^2\cos(c)}{2} & \text{otherwise}\end{cases}}{d} & \text{otherwise}\end{cases}\right) + b^2x^5\left(\begin{cases} x\sin(c) & \text{for } d=0 \\ -\frac{\cos(c+dx)}{d} & \text{otherwise}\end{cases}\right) - 5b^2\left(\begin{cases} \frac{x^6\sin(c)}{6} & \text{for } d=0 \\ -\frac{\begin{cases} \frac{x^4\sin(c+dx)}{d} + \frac{4x^3\cos(c+dx)}{d^2} - \frac{12x^2\sin(c+dx)}{d^3} - \frac{24x\cos(c+dx)}{d^4} + \frac{24\sin(c+dx)}{d^5} & \text{for } d\neq 0 \\ \frac{x^5\cos(c)}{5} & \text{otherwise}\end{cases}}{d} & \text{otherwise}\end{cases}\right)$$

input
```
integrate((b*x**3+a)**2*sin(d*x+c)/x,x)
```

output
```
a**2*sin(c)*Ci(d*x) + a**2*cos(c)*Si(d*x) + 2*a*b*x**2*Piecewise((x*sin(c)
, Eq(d, 0)), (-cos(c + d*x)/d, True)) - 4*a*b*Piecewise((x**3*sin(c)/3, Eq
(d, 0)), (-Piecewise((x*sin(c + d*x)/d + cos(c + d*x)/d**2, Ne(d, 0)), (x*
*2*cos(c)/2, True))/d, True)) + b**2*x**5*Piecewise((x*sin(c), Eq(d, 0)),
(-cos(c + d*x)/d, True)) - 5*b**2*Piecewise((x**6*sin(c)/6, Eq(d, 0)), (-P
iecewise((x**4*sin(c + d*x)/d + 4*x**3*cos(c + d*x)/d**2 - 12*x**2*sin(c +
 d*x)/d**3 - 24*x*cos(c + d*x)/d**4 + 24*sin(c + d*x)/d**5, Ne(d, 0)), (x*
*5*cos(c)/5, True))/d, True))
```

### 3.89.7 Maxima [C] (verification not implemented)

Result contains complex when optimal does not.

Time = 5.68 (sec) , antiderivative size = 147, normalized size of antiderivative = 0.91

$$\int \frac{(a+bx^3)^2 \sin(c+dx)}{x} \, dx = \frac{(a^2(-i\,\mathrm{Ei}(i\,dx)+i\,\mathrm{Ei}(-i\,dx))\cos{(c)}+a^2(\mathrm{Ei}(i\,dx)+\mathrm{Ei}(-i\,dx))\sin{(c)})d^6-2\,(b^2d^5x^5+2\,abd^5x^2-20\,b^2d}{2\,d^6}$$

input
```
integrate((b*x^3+a)^2*sin(d*x+c)/x,x, algorithm="maxima")
```

output
```
1/2*((a^2*(-I*Ei(I*d*x) + I*Ei(-I*d*x))*cos(c) + a^2*(Ei(I*d*x) + Ei(-I*d*
x))*sin(c))*d^6 - 2*(b^2*d^5*x^5 + 2*a*b*d^5*x^2 - 20*b^2*d^3*x^3 - 4*a*b*
d^3 + 120*b^2*d*x)*cos(d*x + c) + 2*(5*b^2*d^4*x^4 + 4*a*b*d^4*x - 60*b^2*
d^2*x^2 + 120*b^2)*sin(d*x + c))/d^6
```

### 3.89.8 Giac [C] (verification not implemented)

Result contains higher order function than in optimal. Order 9 vs. order 4.

Time = 0.34 (sec) , antiderivative size = 921, normalized size of antiderivative = 5.72

$$\int \frac{(a+bx^3)^2 \sin(c+dx)}{x} \, dx = \text{Too large to display}$$

input
```
integrate((b*x^3+a)^2*sin(d*x+c)/x,x, algorithm="giac")
```

output
```
1/2*(2*b^2*d^5*x^5*tan(1/2*d*x + 1/2*c)^2*tan(1/2*c)^2 + 2*b^2*d^5*x^5*tan
(1/2*d*x + 1/2*c)^2 - 2*b^2*d^5*x^5*tan(1/2*c)^2 + 20*b^2*d^4*x^4*tan(1/2*
d*x + 1/2*c)*tan(1/2*c)^2 + 4*a*b*d^5*x^2*tan(1/2*d*x + 1/2*c)^2*tan(1/2*c
)^2 - a^2*d^6*imag_part(cos_integral(d*x))*tan(1/2*d*x + 1/2*c)^2*tan(1/2*
c)^2 + a^2*d^6*imag_part(cos_integral(-d*x))*tan(1/2*d*x + 1/2*c)^2*tan(1/
2*c)^2 - 2*a^2*d^6*sin_integral(d*x)*tan(1/2*d*x + 1/2*c)^2*tan(1/2*c)^2 -
 2*b^2*d^5*x^5 + 2*a^2*d^6*real_part(cos_integral(d*x))*tan(1/2*d*x + 1/2*
c)^2*tan(1/2*c) + 2*a^2*d^6*real_part(cos_integral(-d*x))*tan(1/2*d*x + 1/
2*c)^2*tan(1/2*c) - 40*b^2*d^3*x^3*tan(1/2*d*x + 1/2*c)^2*tan(1/2*c)^2 + 2
0*b^2*d^4*x^4*tan(1/2*d*x + 1/2*c) + 4*a*b*d^5*x^2*tan(1/2*d*x + 1/2*c)^2
+ a^2*d^6*imag_part(cos_integral(d*x))*tan(1/2*d*x + 1/2*c)^2 - a^2*d^6*im
ag_part(cos_integral(-d*x))*tan(1/2*d*x + 1/2*c)^2 + 2*a^2*d^6*sin_integra
l(d*x)*tan(1/2*d*x + 1/2*c)^2 - 4*a*b*d^5*x^2*tan(1/2*c)^2 - a^2*d^6*imag_
part(cos_integral(d*x))*tan(1/2*c)^2 + a^2*d^6*imag_part(cos_integral(-d*x
))*tan(1/2*c)^2 - 2*a^2*d^6*sin_integral(d*x)*tan(1/2*c)^2 - 40*b^2*d^3*x^
3*tan(1/2*d*x + 1/2*c)^2 + 2*a^2*d^6*real_part(cos_integral(d*x))*tan(1/2*
c) + 2*a^2*d^6*real_part(cos_integral(-d*x))*tan(1/2*c) + 40*b^2*d^3*x^3*t
an(1/2*c)^2 + 16*a*b*d^4*x*tan(1/2*d*x + 1/2*c)*tan(1/2*c)^2 - 4*a*b*d^5*x
^2 + a^2*d^6*imag_part(cos_integral(d*x)) - a^2*d^6*imag_part(cos_integral
(-d*x)) + 2*a^2*d^6*sin_integral(d*x) - 240*b^2*d^2*x^2*tan(1/2*d*x + 1...
```

### 3.89.9 Mupad [F(-1)]

Timed out.

$$\int \frac{(a+bx^3)^2 \sin(c+dx)}{x} \, dx = \int \frac{\sin(c+d\,x)\,\left(b\,x^3+a\right)^2}{x} \, dx$$

input
```
int((sin(c + d*x)*(a + b*x^3)^2)/x,x)
```

output
```
int((sin(c + d*x)*(a + b*x^3)^2)/x, x)
```

# 3.90 $\int \frac{(a+bx^3)^2\sin(c+dx)}{x^2}\,dx$



## 3.90.1 Optimal result

Integrand size = 19, antiderivative size = 145

$$\int \frac{(a+bx^3)^2\sin(c+dx)}{x^2}\,dx = -\frac{24b^2\cos(c+dx)}{d^5}-\frac{2abx\cos(c+dx)}{d}+\frac{12b^2x^2\cos(c+dx)}{d^3}-\frac{b^2x^4\cos(c+dx)}{d}+a^2d\cos(c)\,\text{CosIntegral}(dx)+\frac{2ab\sin(c+dx)}{d^2}-\frac{a^2\sin(c+dx)}{x}-\frac{24b^2x\sin(c+dx)}{d^4}+\frac{4b^2x^3\sin(c+dx)}{d^2}-a^2d\sin(c)\text{Si}(dx)$$

output
```
a^2*d*Ci(d*x)*cos(c)-24*b^2*cos(d*x+c)/d^5-2*a*b*x*cos(d*x+c)/d+12*b^2*x^2
*cos(d*x+c)/d^3-b^2*x^4*cos(d*x+c)/d-a^2*d*Si(d*x)*sin(c)+2*a*b*sin(d*x+c)
/d^2-a^2*sin(d*x+c)/x-24*b^2*x*sin(d*x+c)/d^4+4*b^2*x^3*sin(d*x+c)/d^2
```

## 3.90.2 Mathematica [A] (verified)

Time = 0.25 (sec) , antiderivative size = 145, normalized size of antiderivative = 1.00

$$\int \frac{(a+bx^3)^2\sin(c+dx)}{x^2}\,dx = -\frac{24b^2\cos(c+dx)}{d^5}-\frac{2abx\cos(c+dx)}{d}+\frac{12b^2x^2\cos(c+dx)}{d^3}-\frac{b^2x^4\cos(c+dx)}{d}+a^2d\cos(c)\,\text{CosIntegral}(dx)+\frac{2ab\sin(c+dx)}{d^2}-\frac{a^2\sin(c+dx)}{x}-\frac{24b^2x\sin(c+dx)}{d^4}+\frac{4b^2x^3\sin(c+dx)}{d^2}-a^2d\sin(c)\text{Si}(dx)$$

input
```
Integrate[((a + b*x^3)^2*Sin[c + d*x])/x^2,x]
```

output
```
(-24*b^2*Cos[c + d*x])/d^5 - (2*a*b*x*Cos[c + d*x])/d + (12*b^2*x^2*Cos[c
+ d*x])/d^3 - (b^2*x^4*Cos[c + d*x])/d + a^2*d*Cos[c]*CosIntegral[d*x] + (
2*a*b*Sin[c + d*x])/d^2 - (a^2*Sin[c + d*x])/x - (24*b^2*x*Sin[c + d*x])/d
^4 + (4*b^2*x^3*Sin[c + d*x])/d^2 - a^2*d*Sin[c]*SinIntegral[d*x]
```

### 3.90.3 Rubi [A] (verified)

Time = 0.41 (sec) , antiderivative size = 145, normalized size of antiderivative = 1.00, number of steps used = 2, number of rules used = 2, $\frac{\text{number of rules}}{\text{integrand size}}$ = 0.105, Rules used = {3820, 2009}

Below are the steps used by Rubi to obtain the solution. The rule number used for the transformation is given above next to the arrow. The rules definitions used are listed below.

$$\int \frac{(a+bx^3)^2\sin(c+dx)}{x^2}\,dx$$

$$\Big\downarrow \text{3820}$$

$$\int \left(\frac{a^2\sin(c+dx)}{x^2}+2abx\sin(c+dx)+b^2x^4\sin(c+dx)\right)dx$$

$$\Big\downarrow \text{2009}$$

$$a^2d\cos(c)\text{CosIntegral}(dx)-a^2d\sin(c)\text{Si}(dx)-\frac{a^2\sin(c+dx)}{x}+\frac{2ab\sin(c+dx)}{d^2}-\frac{2abx\cos(c+dx)}{d}-\frac{24b^2\cos(c+dx)}{d^5}-\frac{24b^2x\sin(c+dx)}{d^4}+\frac{12b^2x^2\cos(c+dx)}{d^3}+\frac{4b^2x^3\sin(c+dx)}{d^2}-\frac{b^2x^4\cos(c+dx)}{d}$$

input
```
Int[((a + b*x^3)^2*Sin[c + d*x])/x^2,x]
```

output

```
(-24*b^2*Cos[c + d*x])/d^5 - (2*a*b*x*Cos[c + d*x])/d + (12*b^2*x^2*Cos[c
+ d*x])/d^3 - (b^2*x^4*Cos[c + d*x])/d + a^2*d*Cos[c]*CosIntegral[d*x] + (
2*a*b*Sin[c + d*x])/d^2 - (a^2*Sin[c + d*x])/x - (24*b^2*x*Sin[c + d*x])/d
^4 + (4*b^2*x^3*Sin[c + d*x])/d^2 - a^2*d*Sin[c]*SinIntegral[d*x]
```

### 3.90.3.1 Defintions of rubi rules used

rule 2009
```
Int[u_, x_Symbol] :> Simp[IntSum[u, x], x] /; SumQ[u]
```

rule 3820
```
Int[((e_.)*(x_))^(m_.)*((a_) + (b_.)*(x_)^(n_))^(p_.)*Sin[(c_.) + (d_.)*(x_
)], x_Symbol] :> Int[ExpandIntegrand[Sin[c + d*x], (e*x)^m*(a + b*x^n)^p, x
], x] /; FreeQ[{a, b, c, d, e, m, n}, x] && IGtQ[p, 0]
```

## 3.90.4 Maple [C] (warning: unable to verify)

Result contains higher order function than in optimal. Order 9 vs. order 4.

Time = 0.49 (sec) , antiderivative size = 214, normalized size of antiderivative = 1.48

| method | result |
|---|---|
| risch | $-\frac{-\pi \operatorname{csgn}(dx)\sin(c)a^2d^6x+2\operatorname{Si}(dx)\sin(c)a^2d^6x-i\pi\operatorname{csgn}(dx)\cos(c)a^2d^6x+2\cos(dx+c)b^2d^4x^5+2i\operatorname{Si}(dx)\cos(c)a^2d^6 \ldots}{\ldots}$ |
| meijerg | $\frac{16b^2\sqrt{\pi}\sin(c)\left(-\frac{x(d^2)^{\frac{5}{2}}\left(-\frac{5d^2x^2}{2}+15\right)\cos(dx)}{10\sqrt{\pi}\,d^4}+\frac{(d^2)^{\frac{5}{2}}\left(\frac{5}{8}d^4x^4-\frac{15}{2}d^2x^2+15\right)\sin(dx)}{10\sqrt{\pi}\,d^5}\right)}{d^4\sqrt{d^2}}+\frac{16b^2\sqrt{\pi}\cos(c)\left(\frac{3}{2\sqrt{\pi}}-\frac{\left(\frac{3}{8}d^4 \ldots\right.}{\ldots}\right.}{\ldots}$ |
| derivativedivides | $d\left(-\frac{15b^2c^4\cos(dx+c)}{d^6}+a^2\left(-\frac{\sin(dx+c)}{dx}-\operatorname{Si}(dx)\sin(c)+\operatorname{Ci}(dx)\cos(c)\right)+\frac{15(3c^2+2c+1)c^2b^2 \ldots}{\ldots}\right.$ |
| default | $d\left(-\frac{15b^2c^4\cos(dx+c)}{d^6}+a^2\left(-\frac{\sin(dx+c)}{dx}-\operatorname{Si}(dx)\sin(c)+\operatorname{Ci}(dx)\cos(c)\right)+\frac{15(3c^2+2c+1)c^2b^2 \ldots}{\ldots}\right.$ |

input
```
int((b*x^3+a)^2*sin(d*x+c)/x^2,x,method=_RETURNVERBOSE)
```

output
```
-1/2/x/d^5*(-Pi*csgn(d*x)*sin(c)*a^2*d^6*x+2*Si(d*x)*sin(c)*a^2*d^6*x-I*Pi
*csgn(d*x)*cos(c)*a^2*d^6*x+2*cos(d*x+c)*b^2*d^4*x^5+2*I*Si(d*x)*cos(c)*a^
2*d^6*x+2*Ei(1,-I*d*x)*cos(c)*a^2*d^6*x-8*sin(d*x+c)*b^2*d^3*x^4+4*cos(d*x
+c)*a*b*d^4*x^2+2*sin(d*x+c)*a^2*d^5-24*cos(d*x+c)*b^2*d^2*x^3-4*sin(d*x+c
)*a*b*d^3*x+48*sin(d*x+c)*b^2*d*x^2+48*cos(d*x+c)*b^2*x)
```

### 3.90.5 Fricas [A] (verification not implemented)

Time = 0.26 (sec) , antiderivative size = 127, normalized size of antiderivative = 0.88

$$\int \frac{(a+bx^3)^2 \sin(c+dx)}{x^2} \, dx = \frac{a^2d^6x\cos(c)\,\mathrm{Ci}\,(dx) - a^2d^6x\sin(c)\,\mathrm{Si}\,(dx) - (b^2d^4x^5 + 2\,abd^4x^2 - 12\,b^2d^2x^3 + 24\,b^2x)\cos(dx+c) + (4\,b^2}{d^5x}$$

input
```
integrate((b*x^3+a)^2*sin(d*x+c)/x^2,x, algorithm="fricas")
```

output
```
(a^2*d^6*x*cos(c)*cos_integral(d*x) - a^2*d^6*x*sin(c)*sin_integral(d*x) -
 (b^2*d^4*x^5 + 2*a*b*d^4*x^2 - 12*b^2*d^2*x^3 + 24*b^2*x)*cos(d*x + c) +
(4*b^2*d^3*x^4 - a^2*d^5 + 2*a*b*d^3*x - 24*b^2*d*x^2)*sin(d*x + c))/(d^5*
x)
```

### 3.90.6 Sympy [F]

$$\int \frac{(a+bx^3)^2 \sin(c+dx)}{x^2} \, dx = \int \frac{(a+bx^3)^2 \sin(c+dx)}{x^2} \, dx$$

input
```
integrate((b*x**3+a)**2*sin(d*x+c)/x**2,x)
```

output
```
Integral((a + b*x**3)**2*sin(c + d*x)/x**2, x)
```

### 3.90.7 Maxima [C] (verification not implemented)

Result contains complex when optimal does not.

Time = 6.47 (sec) , antiderivative size = 129, normalized size of antiderivative = 0.89

$$\int \frac{(a+bx^3)^2 \sin(c+dx)}{x^2} \, dx = \frac{(a^2(\Gamma(-1,i\,dx) + \Gamma(-1,-i\,dx))\cos(c) + a^2(-i\,\Gamma(-1,i\,dx) + i\,\Gamma(-1,-i\,dx))\sin(c))d^6 - 2\,(b^2d^4x^4 + 2\,ab}{2\,d^5}$$

input
```
integrate((b*x^3+a)^2*sin(d*x+c)/x^2,x, algorithm="maxima")
```

output
```
1/2*((a^2*(gamma(-1, I*d*x) + gamma(-1, -I*d*x))*cos(c) + a^2*(-I*gamma(-1
, I*d*x) + I*gamma(-1, -I*d*x))*sin(c))*d^6 - 2*(b^2*d^4*x^4 + 2*a*b*d^4*x
 - 12*b^2*d^2*x^2 + 24*b^2)*cos(d*x + c) + 4*(2*b^2*d^3*x^3 + a*b*d^3 - 12
*b^2*d*x)*sin(d*x + c))/d^5
```

### 3.90.8 Giac [C] (verification not implemented)

Result contains higher order function than in optimal. Order 9 vs. order 4.

Time = 0.34 (sec) , antiderivative size = 2038, normalized size of antiderivative = 14.06

$$\int \frac{(a+bx^3)^2 \sin(c+dx)}{x^2} \, dx = \text{Too large to display}$$

input
```
integrate((b*x^3+a)^2*sin(d*x+c)/x^2,x, algorithm="giac")
```

output
```
1/2*(2*b^2*d^4*x^5*tan(1/2*d*x + 1/2*c)^2*tan(1/2*d*x)^2*tan(1/2*c)^2 - a^
2*d^6*x*real_part(cos_integral(d*x))*tan(1/2*d*x + 1/2*c)^2*tan(1/2*d*x)^2
*tan(1/2*c)^2 - a^2*d^6*x*real_part(cos_integral(-d*x))*tan(1/2*d*x + 1/2*
c)^2*tan(1/2*d*x)^2*tan(1/2*c)^2 + 2*b^2*d^4*x^5*tan(1/2*d*x + 1/2*c)^2*ta
n(1/2*d*x)^2 - 2*a^2*d^6*x*imag_part(cos_integral(d*x))*tan(1/2*d*x + 1/2*
c)^2*tan(1/2*d*x)^2*tan(1/2*c) + 2*a^2*d^6*x*imag_part(cos_integral(-d*x))
*tan(1/2*d*x + 1/2*c)^2*tan(1/2*d*x)^2*tan(1/2*c) - 4*a^2*d^6*x*sin_integr
al(d*x)*tan(1/2*d*x + 1/2*c)^2*tan(1/2*d*x)^2*tan(1/2*c) + 2*b^2*d^4*x^5*t
an(1/2*d*x + 1/2*c)^2*tan(1/2*c)^2 - 2*b^2*d^4*x^5*tan(1/2*d*x)^2*tan(1/2*
c)^2 + a^2*d^6*x*real_part(cos_integral(d*x))*tan(1/2*d*x + 1/2*c)^2*tan(1
/2*d*x)^2 + a^2*d^6*x*real_part(cos_integral(-d*x))*tan(1/2*d*x + 1/2*c)^2
*tan(1/2*d*x)^2 - a^2*d^6*x*real_part(cos_integral(d*x))*tan(1/2*d*x + 1/2
*c)^2*tan(1/2*c)^2 - a^2*d^6*x*real_part(cos_integral(-d*x))*tan(1/2*d*x +
 1/2*c)^2*tan(1/2*c)^2 - a^2*d^6*x*real_part(cos_integral(d*x))*tan(1/2*d*
x)^2*tan(1/2*c)^2 - a^2*d^6*x*real_part(cos_integral(-d*x))*tan(1/2*d*x)^2
*tan(1/2*c)^2 + 16*b^2*d^3*x^4*tan(1/2*d*x + 1/2*c)*tan(1/2*d*x)^2*tan(1/2
*c)^2 + 4*a*b*d^4*x^2*tan(1/2*d*x + 1/2*c)^2*tan(1/2*d*x)^2*tan(1/2*c)^2 +
 2*b^2*d^4*x^5*tan(1/2*d*x + 1/2*c)^2 - 2*b^2*d^4*x^5*tan(1/2*d*x)^2 - 2*a
^2*d^6*x*imag_part(cos_integral(d*x))*tan(1/2*d*x + 1/2*c)^2*tan(1/2*c) +
2*a^2*d^6*x*imag_part(cos_integral(-d*x))*tan(1/2*d*x + 1/2*c)^2*tan(1/...
```

### 3.90.9 Mupad [F(-1)]

Timed out.

$$\int \frac{(a+bx^3)^2 \sin(c+dx)}{x^2} \, dx = \int \frac{\sin(c+dx)\,(b\,x^3+a)^2}{x^2} \, dx$$

input
```
int((sin(c + d*x)*(a + b*x^3)^2)/x^2,x)
```

output
```
int((sin(c + d*x)*(a + b*x^3)^2)/x^2, x)
```

# 3.91 $\int \frac{(a+bx^3)^2 \sin(c+dx)}{x^3} dx$



## 3.91.1 Optimal result

Integrand size = 19, antiderivative size = 142

$$\begin{aligned}\int \frac{(a+bx^3)^2 \sin(c+dx)}{x^3} dx = & -\frac{2ab\cos(c+dx)}{d} - \frac{a^2 d\cos(c+dx)}{2x} \\ & + \frac{6b^2 x\cos(c+dx)}{d^3} - \frac{b^2x^3\cos(c+dx)}{d} \\ & - \frac{1}{2}a^2d^2\,\text{CosIntegral}(dx)\sin(c) - \frac{6b^2\sin(c+dx)}{d^4} \\ & - \frac{a^2\sin(c+dx)}{2x^2} + \frac{3b^2x^2\sin(c+dx)}{d^2} - \frac{1}{2}a^2d^2\cos(c)\text{Si}(dx)\end{aligned}$$

output
```
-2*a*b*cos(d*x+c)/d-1/2*a^2*d*cos(d*x+c)/x+6*b^2*x*cos(d*x+c)/d^3-b^2*x^3*
cos(d*x+c)/d-1/2*a^2*d^2*cos(c)*Si(d*x)-1/2*a^2*d^2*Ci(d*x)*sin(c)-6*b^2*s
in(d*x+c)/d^4-1/2*a^2*sin(d*x+c)/x^2+3*b^2*x^2*sin(d*x+c)/d^2
```

### 3.91.2 Mathematica [A] (verified)

Time = 0.24 (sec) , antiderivative size = 138, normalized size of antiderivative = 0.97

$$\int \frac{(a+bx^3)^2\sin(c+dx)}{x^3}\,dx = \frac{1}{2}\left(-\frac{4ab\cos(c+dx)}{d}-\frac{a^2d\cos(c+dx)}{x}+\frac{12b^2x\cos(c+dx)}{d^3}-\frac{2b^2x^3\cos(c+dx)}{d}-a^2d^2\operatorname{CosIntegral}(dx)\sin(c)-\frac{12b^2\sin(c+dx)}{d^4}-\frac{a^2\sin(c+dx)}{x^2}+\frac{6b^2x^2\sin(c+dx)}{d^2}-a^2d^2\cos(c)\operatorname{Si}(dx)\right)$$

input
```
Integrate[((a + b*x^3)^2*Sin[c + d*x])/x^3,x]
```

output
```
((-4*a*b*Cos[c + d*x])/d - (a^2*d*Cos[c + d*x])/x + (12*b^2*x*Cos[c + d*x]
)/d^3 - (2*b^2*x^3*Cos[c + d*x])/d - a^2*d^2*CosIntegral[d*x]*Sin[c] - (12
*b^2*Sin[c + d*x])/d^4 - (a^2*Sin[c + d*x])/x^2 + (6*b^2*x^2*Sin[c + d*x])
/d^2 - a^2*d^2*Cos[c]*SinIntegral[d*x])/2
```

### 3.91.3 Rubi [A] (verified)

Time = 0.40 (sec) , antiderivative size = 142, normalized size of antiderivative = 1.00, number of steps used = 2, number of rules used = 2, $\frac{\text{number of rules}}{\text{integrand size}}$ = 0.105, Rules used = {3820, 2009}

Below are the steps used by Rubi to obtain the solution. The rule number used for the transformation is given above next to the arrow. The rules definitions used are listed below.

$$\int \frac{(a+bx^3)^2\sin(c+dx)}{x^3}\,dx$$

$$\Big\downarrow \text{3820}$$

$$\int \left(\frac{a^2\sin(c+dx)}{x^3}+2ab\sin(c+dx)+b^2x^3\sin(c+dx)\right)dx$$

$$\Big\downarrow \text{2009}$$

$$-\frac{1}{2}a^2d^2\sin(c)\operatorname{CosIntegral}(dx)-\frac{1}{2}a^2d^2\cos(c)\operatorname{Si}(dx)-\frac{a^2\sin(c+dx)}{2x^2}-\frac{a^2d\cos(c+dx)}{2x}-\frac{2ab\cos(c+dx)}{d}-\frac{6b^2\sin(c+dx)}{d^4}+\frac{6b^2x\cos(c+dx)}{d^3}+\frac{3b^2x^2\sin(c+dx)}{d^2}-\frac{b^2x^3\cos(c+dx)}{d}$$

input
```
Int[((a + b*x^3)^2*Sin[c + d*x])/x^3,x]
```

output
```
(-2*a*b*Cos[c + d*x])/d - (a^2*d*Cos[c + d*x])/(2*x) + (6*b^2*x*Cos[c + d*
x])/d^3 - (b^2*x^3*Cos[c + d*x])/d - (a^2*d^2*CosIntegral[d*x]*Sin[c])/2 -
 (6*b^2*Sin[c + d*x])/d^4 - (a^2*Sin[c + d*x])/(2*x^2) + (3*b^2*x^2*Sin[c
+ d*x])/d^2 - (a^2*d^2*Cos[c]*SinIntegral[d*x])/2
```

### 3.91.3.1 Defintions of rubi rules used

rule 2009
```
Int[u_, x_Symbol] :> Simp[IntSum[u, x], x] /; SumQ[u]
```

rule 3820
```
Int[((e_.)*(x_))^(m_.)*((a_) + (b_.)*(x_)^(n_))^(p_.)*Sin[(c_.) + (d_.)*(x_
)], x_Symbol] :> Int[ExpandIntegrand[Sin[c + d*x], (e*x)^m*(a + b*x^n)^p, x
], x] /; FreeQ[{a, b, c, d, e, m, n}, x] && IGtQ[p, 0]
```

## 3.91.4 Maple [C] (warning: unable to verify)

Result contains higher order function than in optimal. Order 9 vs. order 4.

Time = 0.50 (sec) , antiderivative size = 210, normalized size of antiderivative = 1.48

| method | result |
|---|---|
| risch | $-\frac{-\pi \operatorname{csgn}(dx)\cos(c)a^2d^6x^2+2\operatorname{Si}(dx)\cos(c)a^2d^6x^2+i\pi \operatorname{csgn}(dx)\sin(c)a^2d^6x^2-2i\operatorname{Si}(dx)\sin(c)a^2d^6x^2-2\operatorname{Ei}_1(-idx)\,s}{}$ |
| derivativedivides | $d^2\left(\frac{20b^2c^3\cos(dx+c)}{d^6}-\frac{2ab\cos(dx+c)}{d^3}+a^2\left(-\frac{\sin(dx+c)}{2d^2x^2}-\frac{\cos(dx+c)}{2dx}-\frac{\operatorname{Si}(dx)\cos(c)}{2}-\frac{\operatorname{Ci}(dx)\sin(c)}{2}\right)+\right.$ |
| default | $d^2\left(\frac{20b^2c^3\cos(dx+c)}{d^6}-\frac{2ab\cos(dx+c)}{d^3}+a^2\left(-\frac{\sin(dx+c)}{2d^2x^2}-\frac{\cos(dx+c)}{2dx}-\frac{\operatorname{Si}(dx)\cos(c)}{2}-\frac{\operatorname{Ci}(dx)\sin(c)}{2}\right)+\right.$ |
| meijerg | $\frac{8b^2\sqrt{\pi}\sin(c)\left(\frac{3}{4\sqrt{\pi}}-\frac{\left(-\frac{3d^2x^2}{2}+3\right)\cos(dx)}{4\sqrt{\pi}}-\frac{dx\left(-\frac{d^2x^2}{2}+3\right)\sin(dx)}{4\sqrt{\pi}}\right)}{d^4}+\frac{8b^2\sqrt{\pi}\cos(c)\left(\frac{xd\left(-\frac{5d^2x^2}{2}+15\right)\cos(dx)}{20\sqrt{\pi}}-\frac{\left(-1\right.}{}\right.}{d^4}$ |

input
```
int((b*x^3+a)^2*sin(d*x+c)/x^3,x,method=_RETURNVERBOSE)
```

output
```
-1/4/x^2/d^4*(-Pi*csgn(d*x)*cos(c)*a^2*d^6*x^2+2*Si(d*x)*cos(c)*a^2*d^6*x^
2+I*Pi*csgn(d*x)*sin(c)*a^2*d^6*x^2-2*I*Si(d*x)*sin(c)*a^2*d^6*x^2-2*Ei(1,
-I*d*x)*sin(c)*a^2*d^6*x^2+4*cos(d*x+c)*b^2*d^3*x^5-12*sin(d*x+c)*b^2*d^2*
x^4+2*cos(d*x+c)*a^2*d^5*x+8*cos(d*x+c)*a*b*d^3*x^2+2*sin(d*x+c)*a^2*d^4-2
4*cos(d*x+c)*b^2*d*x^3+24*sin(d*x+c)*b^2*x^2)
```

### 3.91.5 Fricas [A] (verification not implemented)

Time = 0.28 (sec) , antiderivative size = 123, normalized size of antiderivative = 0.87

$$\int \frac{(a+bx^3)^2 \sin(c+dx)}{x^3} \, dx = -\frac{a^2d^6x^2 \operatorname{Ci}(dx) \sin(c) + a^2d^6x^2 \cos(c) \operatorname{Si}(dx) + (2b^2d^3x^5 + a^2d^5x + 4abd^3x^2 - 12b^2dx^3) \cos(dx+c) -}{2d^4x^2}$$

input
```
integrate((b*x^3+a)^2*sin(d*x+c)/x^3,x, algorithm="fricas")
```

output
```
-1/2*(a^2*d^6*x^2*cos_integral(d*x)*sin(c) + a^2*d^6*x^2*cos(c)*sin_integr
al(d*x) + (2*b^2*d^3*x^5 + a^2*d^5*x + 4*a*b*d^3*x^2 - 12*b^2*d*x^3)*cos(d
*x + c) - (6*b^2*d^2*x^4 - a^2*d^4 - 12*b^2*x^2)*sin(d*x + c))/(d^4*x^2)
```

### 3.91.6 Sympy [F]

$$\int \frac{(a+bx^3)^2 \sin(c+dx)}{x^3} \, dx = \int \frac{(a+bx^3)^2 \sin(c+dx)}{x^3} \, dx$$

input
```
integrate((b*x**3+a)**2*sin(d*x+c)/x**3,x)
```

output
```
Integral((a + b*x**3)**2*sin(c + d*x)/x**3, x)
```

### 3.91.7 Maxima [C] (verification not implemented)

Result contains complex when optimal does not.

Time = 2.19 (sec) , antiderivative size = 110, normalized size of antiderivative = 0.77

$$\int \frac{(a+bx^3)^2 \sin(c+dx)}{x^3}\,dx$$
$$= \frac{(a^2(i\,\Gamma(-2,i\,dx) - i\,\Gamma(-2,-i\,dx))\cos(c) + a^2(\Gamma(-2,i\,dx) + \Gamma(-2,-i\,dx))\sin(c))d^6 - 2\,(b^2d^3x^3 + 2\,abd}{2\,d^4}$$

input
```
integrate((b*x^3+a)^2*sin(d*x+c)/x^3,x, algorithm="maxima")
```

output
```
1/2*((a^2*(I*gamma(-2, I*d*x) - I*gamma(-2, -I*d*x))*cos(c) + a^2*(gamma(-
2, I*d*x) + gamma(-2, -I*d*x))*sin(c))*d^6 - 2*(b^2*d^3*x^3 + 2*a*b*d^3 -
6*b^2*d*x)*cos(d*x + c) + 6*(b^2*d^2*x^2 - 2*b^2)*sin(d*x + c))/d^4
```

### 3.91.8 Giac [C] (verification not implemented)

Result contains higher order function than in optimal. Order 9 vs. order 4.

Time = 0.32 (sec) , antiderivative size = 2171, normalized size of antiderivative = 15.29

$$\int \frac{(a+bx^3)^2 \sin(c+dx)}{x^3}\,dx = \text{Too large to display}$$

input
```
integrate((b*x^3+a)^2*sin(d*x+c)/x^3,x, algorithm="giac")
```

output
```
1/4*(a^2*d^6*x^2*imag_part(cos_integral(d*x))*tan(1/2*d*x + 1/2*c)^2*tan(1
/2*d*x)^2*tan(1/2*c)^2 - a^2*d^6*x^2*imag_part(cos_integral(-d*x))*tan(1/2
*d*x + 1/2*c)^2*tan(1/2*d*x)^2*tan(1/2*c)^2 + 2*a^2*d^6*x^2*sin_integral(d
*x)*tan(1/2*d*x + 1/2*c)^2*tan(1/2*d*x)^2*tan(1/2*c)^2 - 2*a^2*d^6*x^2*rea
l_part(cos_integral(d*x))*tan(1/2*d*x + 1/2*c)^2*tan(1/2*d*x)^2*tan(1/2*c)
 - 2*a^2*d^6*x^2*real_part(cos_integral(-d*x))*tan(1/2*d*x + 1/2*c)^2*tan(
1/2*d*x)^2*tan(1/2*c) + 4*b^2*d^3*x^5*tan(1/2*d*x + 1/2*c)^2*tan(1/2*d*x)^
2*tan(1/2*c)^2 - a^2*d^6*x^2*imag_part(cos_integral(d*x))*tan(1/2*d*x + 1/
2*c)^2*tan(1/2*d*x)^2 + a^2*d^6*x^2*imag_part(cos_integral(-d*x))*tan(1/2*
d*x + 1/2*c)^2*tan(1/2*d*x)^2 - 2*a^2*d^6*x^2*sin_integral(d*x)*tan(1/2*d*
x + 1/2*c)^2*tan(1/2*d*x)^2 + a^2*d^6*x^2*imag_part(cos_integral(d*x))*tan
(1/2*d*x + 1/2*c)^2*tan(1/2*c)^2 - a^2*d^6*x^2*imag_part(cos_integral(-d*x
))*tan(1/2*d*x + 1/2*c)^2*tan(1/2*c)^2 + 2*a^2*d^6*x^2*sin_integral(d*x)*t
an(1/2*d*x + 1/2*c)^2*tan(1/2*c)^2 + a^2*d^6*x^2*imag_part(cos_integral(d*
x))*tan(1/2*d*x)^2*tan(1/2*c)^2 - a^2*d^6*x^2*imag_part(cos_integral(-d*x)
)*tan(1/2*d*x)^2*tan(1/2*c)^2 + 2*a^2*d^6*x^2*sin_integral(d*x)*tan(1/2*d*
x)^2*tan(1/2*c)^2 + 4*b^2*d^3*x^5*tan(1/2*d*x + 1/2*c)^2*tan(1/2*d*x)^2 -
2*a^2*d^6*x^2*real_part(cos_integral(d*x))*tan(1/2*d*x + 1/2*c)^2*tan(1/2*
c) - 2*a^2*d^6*x^2*real_part(cos_integral(-d*x))*tan(1/2*d*x + 1/2*c)^2*ta
n(1/2*c) - 2*a^2*d^6*x^2*real_part(cos_integral(d*x))*tan(1/2*d*x)^2*ta...
```

### 3.91.9 Mupad [F(-1)]

Timed out.

$$\int \frac{(a+bx^3)^2 \sin(c+dx)}{x^3} dx = \int \frac{\sin(c+d\,x)\,(b\,x^3+a)^2}{x^3} dx$$

input
```
int((sin(c + d*x)*(a + b*x^3)^2)/x^3,x)
```

output
```
int((sin(c + d*x)*(a + b*x^3)^2)/x^3, x)
```

# 3.92 $\int \frac{(a+bx^3)^2 \sin(c+dx)}{x^4} \, dx$



## 3.92.1 Optimal result

Integrand size = 19, antiderivative size = 151

$$\begin{aligned}\int \frac{(a+bx^3)^2 \sin(c+dx)}{x^4} \, dx = {} & \frac{2b^2\cos(c+dx)}{d^3} - \frac{a^2 d\cos(c+dx)}{6x^2} - \frac{b^2x^2\cos(c+dx)}{d} \\ & - \frac{1}{6}a^2d^3\cos(c)\,\text{CosIntegral}(dx) + 2ab\,\text{CosIntegral}(dx)\sin(c) \\ & - \frac{a^2\sin(c+dx)}{3x^3} + \frac{a^2d^2\sin(c+dx)}{6x} + \frac{2b^2x\sin(c+dx)}{d^2} \\ & + 2ab\cos(c)\text{Si}(dx) + \frac{1}{6}a^2d^3\sin(c)\text{Si}(dx)\end{aligned}$$

output
```
-1/6*a^2*d^3*Ci(d*x)*cos(c)+2*b^2*cos(d*x+c)/d^3-1/6*a^2*d*cos(d*x+c)/x^2-
b^2*x^2*cos(d*x+c)/d+2*a*b*cos(c)*Si(d*x)+2*a*b*Ci(d*x)*sin(c)+1/6*a^2*d^3
*Si(d*x)*sin(c)-1/3*a^2*sin(d*x+c)/x^3+1/6*a^2*d^2*sin(d*x+c)/x+2*b^2*x*si
n(d*x+c)/d^2
```

### 3.92.2 Mathematica [A] (verified)

Time = 0.45 (sec) , antiderivative size = 135, normalized size of antiderivative = 0.89

$$\int \frac{(a+bx^3)^2 \sin(c+dx)}{x^4} dx = \frac{1}{6}\left(\frac{12b^2\cos(c+dx)}{d^3} - \frac{a^2d\cos(c+dx)}{x^2} - \frac{6b^2x^2\cos(c+dx)}{d} - a\,\text{CosIntegral}(dx)\left(ad^3\cos(c) - 12b\sin(c)\right) - \frac{2a^2\sin(c+dx)}{x^3} + \frac{a^2d^2\sin(c+dx)}{x} + \frac{12b^2x\sin(c+dx)}{d^2} + a\left(12b\cos(c) + ad^3\sin(c)\right)\text{Si}(dx)\right)$$

input
```
Integrate[((a + b*x^3)^2*Sin[c + d*x])/x^4,x]
```

output
```
((12*b^2*Cos[c + d*x])/d^3 - (a^2*d*Cos[c + d*x])/x^2 - (6*b^2*x^2*Cos[c +
 d*x])/d - a*CosIntegral[d*x]*(a*d^3*Cos[c] - 12*b*Sin[c]) - (2*a^2*Sin[c
+ d*x])/x^3 + (a^2*d^2*Sin[c + d*x])/x + (12*b^2*x*Sin[c + d*x])/d^2 + a*(
12*b*Cos[c] + a*d^3*Sin[c])*SinIntegral[d*x])/6
```

### 3.92.3 Rubi [A] (verified)

Time = 0.43 (sec) , antiderivative size = 151, normalized size of antiderivative = 1.00, number of steps used = 2, number of rules used = 2, $\frac{\text{number of rules}}{\text{integrand size}}$ = 0.105, Rules used = {3820, 2009}

Below are the steps used by Rubi to obtain the solution. The rule number used for the transformation is given above next to the arrow. The rules definitions used are listed below.

$$\int \frac{(a+bx^3)^2 \sin(c+dx)}{x^4} dx$$

$$\Big\downarrow \text{ 3820}$$

$$\int \left(\frac{a^2\sin(c+dx)}{x^4} + \frac{2ab\sin(c+dx)}{x} + b^2x^2\sin(c+dx)\right) dx$$

$$\Big\downarrow \text{ 2009}$$

$$-\frac{1}{6}a^2d^3\cos(c)\,\text{CosIntegral}(dx)+\frac{1}{6}a^2d^3\sin(c)\text{Si}(dx)+\frac{a^2d^2\sin(c+dx)}{6x}-\frac{a^2\sin(c+dx)}{3x^3}-\frac{a^2d\cos(c+dx)}{6x^2}+2ab\sin(c)\,\text{CosIntegral}(dx)+2ab\cos(c)\text{Si}(dx)+\frac{2b^2\cos(c+dx)}{d^3}+\frac{2b^2x\sin(c+dx)}{d^2}-\frac{b^2x^2\cos(c+dx)}{d}$$

input
```
Int[((a + b*x^3)^2*Sin[c + d*x])/x^4,x]
```

output
```
(2*b^2*Cos[c + d*x])/d^3 - (a^2*d*Cos[c + d*x])/(6*x^2) - (b^2*x^2*Cos[c +
 d*x])/d - (a^2*d^3*Cos[c]*CosIntegral[d*x])/6 + 2*a*b*CosIntegral[d*x]*Si
n[c] - (a^2*Sin[c + d*x])/(3*x^3) + (a^2*d^2*Sin[c + d*x])/(6*x) + (2*b^2*
x*Sin[c + d*x])/d^2 + 2*a*b*Cos[c]*SinIntegral[d*x] + (a^2*d^3*Sin[c]*SinI
ntegral[d*x])/6
```

### 3.92.3.1 Defintions of rubi rules used

rule 2009
```
Int[u_, x_Symbol] :> Simp[IntSum[u, x], x] /; SumQ[u]
```

rule 3820
```
Int[((e_.)*(x_))^(m_.)*((a_) + (b_.)*(x_)^(n_))^(p_.)*Sin[(c_.) + (d_.)*(x_
)], x_Symbol] :> Int[ExpandIntegrand[Sin[c + d*x], (e*x)^m*(a + b*x^n)^p, x
], x] /; FreeQ[{a, b, c, d, e, m, n}, x] && IGtQ[p, 0]
```

## 3.92.4 Maple [A] (verified)

Time = 0.49 (sec) , antiderivative size = 196, normalized size of antiderivative = 1.30

| method | result |
|---|---|
| derivativedivides | $d^3\left(\frac{2ab(\text{Si}(dx)\cos(c)+\text{Ci}(dx)\sin(c))}{d^3}-\frac{15b^2c^2\cos(dx+c)}{d^6}+a^2\left(-\frac{\sin(dx+c)}{3d^3x^3}-\frac{\cos(dx+c)}{6d^2x^2}+\frac{\sin(dx+c)}{6dx}+\text{Si}\right.\right.$ |
| default | $d^3\left(\frac{2ab(\text{Si}(dx)\cos(c)+\text{Ci}(dx)\sin(c))}{d^3}-\frac{15b^2c^2\cos(dx+c)}{d^6}+a^2\left(-\frac{\sin(dx+c)}{3d^3x^3}-\frac{\cos(dx+c)}{6d^2x^2}+\frac{\sin(dx+c)}{6dx}+\text{Si}\right.\right.$ |
| risch | $-\frac{\pi\ \text{csgn}(dx)\sin(c)a^2d^6x^3-2\ \text{Si}(dx)\sin(c)a^2d^6x^3+i\pi\ \text{csgn}(dx)\cos(c)a^2d^6x^3-2i\,\text{Si}(dx)\cos(c)a^2d^6x^3+12\pi\ \text{csgn}(dx)\,\text{c}}{}$ |
| meijerg | $\frac{4b^2\sqrt{\pi}\,\sin(c)\left(\frac{x\left(d^2\right)^{\frac{3}{2}}\cos(dx)}{2\sqrt{\pi}\,d^2}-\frac{\left(d^2\right)^{\frac{3}{2}}\left(-\frac{3d^2x^2}{2}+3\right)\sin(dx)}{6\sqrt{\pi}\,d^3}\right)}{d^2\sqrt{d^2}}+\frac{4b^2\sqrt{\pi}\,\cos(c)\left(-\frac{1}{2\sqrt{\pi}}+\frac{\left(-\frac{d^2x^2}{2}+1\right)\cos(dx)}{2\sqrt{\pi}}+\frac{dx\sin(d}{2\sqrt{\pi}}\right.}{d^3}$ |

input
```
int((b*x^3+a)^2*sin(d*x+c)/x^4,x,method=_RETURNVERBOSE)
```

output
```
d^3*(2/d^3*a*b*(Si(d*x)*cos(c)+Ci(d*x)*sin(c))-15/d^6*b^2*c^2*cos(d*x+c)+a
^2*(-1/3*sin(d*x+c)/d^3/x^3-1/6*cos(d*x+c)/d^2/x^2+1/6*sin(d*x+c)/d/x+1/6*
Si(d*x)*sin(c)-1/6*Ci(d*x)*cos(c))+(10*c^2+4*c+1)/d^6*b^2*(-(d*x+c)^2*cos(
d*x+c)+2*cos(d*x+c)+2*(d*x+c)*sin(d*x+c))-6*c*b^2*(4*c+1)/d^6*(sin(d*x+c)-
cos(d*x+c)*(d*x+c)))
```

### 3.92.5 Fricas [A] (verification not implemented)

Time = 0.27 (sec) , antiderivative size = 145, normalized size of antiderivative = 0.96

$$\int \frac{(a+bx^3)^2 \sin(c+dx)}{x^4}\,dx = -\frac{(6\,b^2d^2x^5 + a^2d^4x - 12\,b^2x^3)\cos(dx+c) + (a^2d^6x^3\,\mathrm{Ci}\,(dx) - 12\,abd^3x^3\,\mathrm{Si}\,(dx))\cos(c) - (a^2d^5x^2 + 12}{6\,d^3x^3}$$

input
```
integrate((b*x^3+a)^2*sin(d*x+c)/x^4,x, algorithm="fricas")
```

output
```
-1/6*((6*b^2*d^2*x^5 + a^2*d^4*x - 12*b^2*x^3)*cos(d*x + c) + (a^2*d^6*x^3
*cos_integral(d*x) - 12*a*b*d^3*x^3*sin_integral(d*x))*cos(c) - (a^2*d^5*x
^2 + 12*b^2*d*x^4 - 2*a^2*d^3)*sin(d*x + c) - (a^2*d^6*x^3*sin_integral(d*
x) + 12*a*b*d^3*x^3*cos_integral(d*x))*sin(c))/(d^3*x^3)
```

### 3.92.6 Sympy [F]

$$\int \frac{(a+bx^3)^2 \sin(c+dx)}{x^4}\,dx = \int \frac{(a+bx^3)^2 \sin(c+dx)}{x^4}\,dx$$

input
```
integrate((b*x**3+a)**2*sin(d*x+c)/x**4,x)
```

output
```
Integral((a + b*x**3)**2*sin(c + d*x)/x**4, x)
```

### 3.92.7 Maxima [C] (verification not implemented)

Result contains complex when optimal does not.

Time = 7.11 (sec) , antiderivative size = 173, normalized size of antiderivative = 1.15

$$\int \frac{(a+bx^3)^2 \sin(c+dx)}{x^4} \, dx =$$
$$-\frac{((a^2(\Gamma(-3,i\,dx)+\Gamma(-3,-i\,dx))\cos(c)-a^2(i\,\Gamma(-3,i\,dx)-i\,\Gamma(-3,-i\,dx))\sin(c))d^6+12\,(ab(-i\,\Gamma(-$$

input
```
integrate((b*x^3+a)^2*sin(d*x+c)/x^4,x, algorithm="maxima")
```

output
```
-1/2*(((a^2*(gamma(-3, I*d*x) + gamma(-3, -I*d*x))*cos(c) - a^2*(I*gamma(-
3, I*d*x) - I*gamma(-3, -I*d*x))*sin(c))*d^6 + 12*(a*b*(-I*gamma(-3, I*d*x
) + I*gamma(-3, -I*d*x))*cos(c) - a*b*(gamma(-3, I*d*x) + gamma(-3, -I*d*x
))*sin(c))*d^3)*x^3 + 2*(b^2*d^2*x^5 + 2*a*b*d^2*x^2 - 2*b^2*x^3 - 4*a*b)*
cos(d*x + c) - 4*(b^2*d*x^4 - a*b*d*x)*sin(d*x + c))/(d^3*x^3)
```

### 3.92.8 Giac [C] (verification not implemented)

Result contains higher order function than in optimal. Order 9 vs. order 4.

Time = 0.34 (sec) , antiderivative size = 1181, normalized size of antiderivative = 7.82

$$\int \frac{(a+bx^3)^2 \sin(c+dx)}{x^4} \, dx = \text{Too large to display}$$

input
```
integrate((b*x^3+a)^2*sin(d*x+c)/x^4,x, algorithm="giac")
```

output
```
1/12*(a^2*d^6*x^3*real_part(cos_integral(d*x))*tan(1/2*d*x)^2*tan(1/2*c)^2
 + a^2*d^6*x^3*real_part(cos_integral(-d*x))*tan(1/2*d*x)^2*tan(1/2*c)^2 +
 2*a^2*d^6*x^3*imag_part(cos_integral(d*x))*tan(1/2*d*x)^2*tan(1/2*c) - 2*
a^2*d^6*x^3*imag_part(cos_integral(-d*x))*tan(1/2*d*x)^2*tan(1/2*c) + 4*a^
2*d^6*x^3*sin_integral(d*x)*tan(1/2*d*x)^2*tan(1/2*c) - a^2*d^6*x^3*real_p
art(cos_integral(d*x))*tan(1/2*d*x)^2 - a^2*d^6*x^3*real_part(cos_integral
(-d*x))*tan(1/2*d*x)^2 + a^2*d^6*x^3*real_part(cos_integral(d*x))*tan(1/2*
c)^2 + a^2*d^6*x^3*real_part(cos_integral(-d*x))*tan(1/2*c)^2 + 2*a^2*d^6*
x^3*imag_part(cos_integral(d*x))*tan(1/2*c) - 2*a^2*d^6*x^3*imag_part(cos_
integral(-d*x))*tan(1/2*c) + 4*a^2*d^6*x^3*sin_integral(d*x)*tan(1/2*c) -
12*b^2*d^2*x^5*tan(1/2*d*x)^2*tan(1/2*c)^2 - 12*a*b*d^3*x^3*imag_part(cos_
integral(d*x))*tan(1/2*d*x)^2*tan(1/2*c)^2 + 12*a*b*d^3*x^3*imag_part(cos_
integral(-d*x))*tan(1/2*d*x)^2*tan(1/2*c)^2 - 24*a*b*d^3*x^3*sin_integral(
d*x)*tan(1/2*d*x)^2*tan(1/2*c)^2 - a^2*d^6*x^3*real_part(cos_integral(d*x)
) - a^2*d^6*x^3*real_part(cos_integral(-d*x)) - 4*a^2*d^5*x^2*tan(1/2*d*x)
^2*tan(1/2*c) + 24*a*b*d^3*x^3*real_part(cos_integral(d*x))*tan(1/2*d*x)^2
*tan(1/2*c) + 24*a*b*d^3*x^3*real_part(cos_integral(-d*x))*tan(1/2*d*x)^2*
tan(1/2*c) - 4*a^2*d^5*x^2*tan(1/2*d*x)*tan(1/2*c)^2 + 12*b^2*d^2*x^5*tan(
1/2*d*x)^2 + 12*a*b*d^3*x^3*imag_part(cos_integral(d*x))*tan(1/2*d*x)^2 -
12*a*b*d^3*x^3*imag_part(cos_integral(-d*x))*tan(1/2*d*x)^2 + 24*a*b*d^...
```

### 3.92.9 Mupad [F(-1)]

Timed out.

$$\int \frac{(a+bx^3)^2 \sin(c+dx)}{x^4}\,dx = \int \frac{\sin(c+d\,x)\,\left(b\,x^3+a\right)^2}{x^4}\,dx$$

input
```
int((sin(c + d*x)*(a + b*x^3)^2)/x^4,x)
```

output
```
int((sin(c + d*x)*(a + b*x^3)^2)/x^4, x)
```

# 3.93 $\int \frac{(a+bx^3)^2 \sin(c+dx)}{x^5} dx$



## 3.93.1 Optimal result

Integrand size = 19, antiderivative size = 167

$$\int \frac{(a+bx^3)^2 \sin(c+dx)}{x^5} dx = -\frac{a^2 d\cos(c+dx)}{12x^3} + \frac{a^2 d^3 \cos(c+dx)}{24x} - \frac{b^2 x\cos(c+dx)}{d} + 2abd\cos(c)\,\text{CosIntegral}(dx) + \frac{1}{24}a^2 d^4\,\text{CosIntegral}(dx)\sin(c) + \frac{b^2\sin(c+dx)}{d^2} - \frac{a^2\sin(c+dx)}{4x^4} + \frac{a^2 d^2\sin(c+dx)}{24x^2} - \frac{2ab\sin(c+dx)}{x} + \frac{1}{24}a^2 d^4\cos(c)\text{Si}(dx) - 2abd\sin(c)\text{Si}(dx)$$

output
```
2*a*b*d*Ci(d*x)*cos(c)-1/12*a^2*d*cos(d*x+c)/x^3+1/24*a^2*d^3*cos(d*x+c)/x
-b^2*x*cos(d*x+c)/d+1/24*a^2*d^4*cos(c)*Si(d*x)+1/24*a^2*d^4*Ci(d*x)*sin(c
)-2*a*b*d*Si(d*x)*sin(c)+b^2*sin(d*x+c)/d^2-1/4*a^2*sin(d*x+c)/x^4+1/24*a^
2*d^2*sin(d*x+c)/x^2-2*a*b*sin(d*x+c)/x
```

### 3.93.2 Mathematica [A] (verified)

Time = 0.37 (sec) , antiderivative size = 148, normalized size of antiderivative = 0.89

$$\int \frac{(a+bx^3)^2\sin(c+dx)}{x^5}\,dx = \frac{1}{24}\Bigg(-\frac{2a^2d\cos(c+dx)}{x^3}+\frac{a^2d^3\cos(c+dx)}{x} - \frac{24b^2x\cos(c+dx)}{d} + ad\,\mathrm{CosIntegral}(dx)\left(48b\cos(c)+ad^3\sin(c)\right) + \frac{24b^2\sin(c+dx)}{d^2}-\frac{6a^2\sin(c+dx)}{x^4}+\frac{a^2d^2\sin(c+dx)}{x^2} - \frac{48ab\sin(c+dx)}{x}+ad\left(ad^3\cos(c)-48b\sin(c)\right)\mathrm{Si}(dx)\Bigg)$$

input
```
Integrate[((a + b*x^3)^2*Sin[c + d*x])/x^5,x]
```

output
```
((-2*a^2*d*Cos[c + d*x])/x^3 + (a^2*d^3*Cos[c + d*x])/x - (24*b^2*x*Cos[c
+ d*x])/d + a*d*CosIntegral[d*x]*(48*b*Cos[c] + a*d^3*Sin[c]) + (24*b^2*Si
n[c + d*x])/d^2 - (6*a^2*Sin[c + d*x])/x^4 + (a^2*d^2*Sin[c + d*x])/x^2 -
(48*a*b*Sin[c + d*x])/x + a*d*(a*d^3*Cos[c] - 48*b*Sin[c])*SinIntegral[d*x
])/24
```

### 3.93.3 Rubi [A] (verified)

Time = 0.47 (sec) , antiderivative size = 167, normalized size of antiderivative = 1.00, number of steps used = 2, number of rules used = 2, $\frac{\text{number of rules}}{\text{integrand size}}$ = 0.105, Rules used = {3820, 2009}

Below are the steps used by Rubi to obtain the solution. The rule number used for the transformation is given above next to the arrow. The rules definitions used are listed below.

$$\int \frac{(a+bx^3)^2\sin(c+dx)}{x^5}\,dx$$

$$\Big\downarrow \text{3820}$$

$$\int \left(\frac{a^2\sin(c+dx)}{x^5}+\frac{2ab\sin(c+dx)}{x^2}+b^2x\sin(c+dx)\right)dx$$

$$\Big\downarrow \text{2009}$$

$$\frac{1}{24}a^2d^4\sin(c)\,\text{CosIntegral}(dx)+\frac{1}{24}a^2d^4\cos(c)\text{Si}(dx)+\frac{a^2d^3\cos(c+dx)}{24x}+\frac{a^2d^2\sin(c+dx)}{24x^2}-\frac{a^2\sin(c+dx)}{4x^4}-\frac{a^2d\cos(c+dx)}{12x^3}+2abd\cos(c)\,\text{CosIntegral}(dx)-2abd\sin(c)\text{Si}(dx)-\frac{2ab\sin(c+dx)}{x}+\frac{b^2\sin(c+dx)}{d^2}-\frac{b^2x\cos(c+dx)}{d}$$

input
```
Int[((a + b*x^3)^2*Sin[c + d*x])/x^5,x]
```

output
```
-1/12*(a^2*d*Cos[c + d*x])/x^3 + (a^2*d^3*Cos[c + d*x])/(24*x) - (b^2*x*Co
s[c + d*x])/d + 2*a*b*d*Cos[c]*CosIntegral[d*x] + (a^2*d^4*CosIntegral[d*x
]*Sin[c])/24 + (b^2*Sin[c + d*x])/d^2 - (a^2*Sin[c + d*x])/(4*x^4) + (a^2*
d^2*Sin[c + d*x])/(24*x^2) - (2*a*b*Sin[c + d*x])/x + (a^2*d^4*Cos[c]*SinI
ntegral[d*x])/24 - 2*a*b*d*Sin[c]*SinIntegral[d*x]
```

### 3.93.3.1 Defintions of rubi rules used

rule 2009
```
Int[u_, x_Symbol] :> Simp[IntSum[u, x], x] /; SumQ[u]
```

rule 3820
```
Int[((e_.)*(x_))^(m_.)*((a_) + (b_.)*(x_)^(n_))^(p_.)*Sin[(c_.) + (d_.)*(x_
)], x_Symbol] :> Int[ExpandIntegrand[Sin[c + d*x], (e*x)^m*(a + b*x^n)^p, x
], x] /; FreeQ[{a, b, c, d, e, m, n}, x] && IGtQ[p, 0]
```

## 3.93.4 Maple [A] (verified)

Time = 0.56 (sec) , antiderivative size = 167, normalized size of antiderivative = 1.00

| method | result |
|---|---|
| derivativedivides | $d^4\left(\frac{2ab\left(-\frac{\sin(dx+c)}{dx}-\text{Si}(dx)\sin(c)+\text{Ci}(dx)\cos(c)\right)}{d^3}+a^2\left(-\frac{\sin(dx+c)}{4d^4x^4}-\frac{\cos(dx+c)}{12d^3x^3}+\frac{\sin(dx+c)}{24d^2x^2}+\frac{\cos(dx+c)}{24dx}\right.\right.$ |
| default | $d^4\left(\frac{2ab\left(-\frac{\sin(dx+c)}{dx}-\text{Si}(dx)\sin(c)+\text{Ci}(dx)\cos(c)\right)}{d^3}+a^2\left(-\frac{\sin(dx+c)}{4d^4x^4}-\frac{\cos(dx+c)}{12d^3x^3}+\frac{\sin(dx+c)}{24d^2x^2}+\frac{\cos(dx+c)}{24dx}\right.\right.$ |
| risch | $\frac{-\pi\ \text{csgn}(dx)\cos(c)a^2d^6x^4+2\ \text{Si}(dx)\cos(c)a^2d^6x^4-2i\ \text{Si}(dx)\sin(c)a^2d^6x^4-96i\ \text{Si}(dx)\cos(c)ab\,d^3x^4+48\pi\ \text{csgn}(dx)\sin(}{}$ |
| meijerg | $\frac{2b^2\sqrt{\pi}\sin(c)\left(-\frac{1}{2\sqrt{\pi}}+\frac{\cos(dx)}{2\sqrt{\pi}}+\frac{dx\sin(dx)}{2\sqrt{\pi}}\right)}{d^2}+\frac{2b^2\sqrt{\pi}\cos(c)\left(-\frac{dx\cos(dx)}{2\sqrt{\pi}}+\frac{\sin(dx)}{2\sqrt{\pi}}\right)}{d^2}+\frac{d^2ab\sqrt{\pi}\sin(c)\left(-\frac{4d^2\cos\left(x\sqrt{}\right.}{x\left(d^2\right)^{\frac{3}{2}}\sqrt{}}\right.}{2\sqrt{d^2}}$ |

input
```
int((b*x^3+a)^2*sin(d*x+c)/x^5,x,method=_RETURNVERBOSE)
```

output
```
d^4*(2/d^3*a*b*(-sin(d*x+c)/d/x-Si(d*x)*sin(c)+Ci(d*x)*cos(c))+a^2*(-1/4*s
in(d*x+c)/d^4/x^4-1/12*cos(d*x+c)/d^3/x^3+1/24*sin(d*x+c)/d^2/x^2+1/24*cos
(d*x+c)/d/x+1/24*Si(d*x)*cos(c)+1/24*Ci(d*x)*sin(c))+6/d^6*b^2*c*cos(d*x+c
)+(5*c+1)/d^6*b^2*(sin(d*x+c)-cos(d*x+c)*(d*x+c)))
```

### 3.93.5 Fricas [A] (verification not implemented)

Time = 0.30 (sec) , antiderivative size = 153, normalized size of antiderivative = 0.92

$$\int \frac{(a+bx^3)^2\sin(c+dx)}{x^5}\,dx = \frac{(a^2d^5x^3 - 24\,b^2dx^5 - 2\,a^2d^3x)\cos(dx+c) + (a^2d^6x^4\,\mathrm{Si}(dx) + 48\,abd^3x^4\,\mathrm{Ci}(dx))\cos(c) + (a^2d^4x^2 - 48\,a}{24\,d^2x^4}$$

input
```
integrate((b*x^3+a)^2*sin(d*x+c)/x^5,x, algorithm="fricas")
```

output
```
1/24*((a^2*d^5*x^3 - 24*b^2*d*x^5 - 2*a^2*d^3*x)*cos(d*x + c) + (a^2*d^6*x
^4*sin_integral(d*x) + 48*a*b*d^3*x^4*cos_integral(d*x))*cos(c) + (a^2*d^4
*x^2 - 48*a*b*d^2*x^3 + 24*b^2*x^4 - 6*a^2*d^2)*sin(d*x + c) + (a^2*d^6*x^
4*cos_integral(d*x) - 48*a*b*d^3*x^4*sin_integral(d*x))*sin(c))/(d^2*x^4)
```

### 3.93.6 Sympy [F]

$$\int \frac{(a+bx^3)^2\sin(c+dx)}{x^5}\,dx = \int \frac{(a+bx^3)^2\sin(c+dx)}{x^5}\,dx$$

input
```
integrate((b*x**3+a)**2*sin(d*x+c)/x**5,x)
```

output
```
Integral((a + b*x**3)**2*sin(c + d*x)/x**5, x)
```

### 3.93.7 Maxima [C] (verification not implemented)

Result contains complex when optimal does not.

Time = 5.95 (sec) , antiderivative size = 164, normalized size of antiderivative = 0.98

$$\int \frac{(a+bx^3)^2 \sin(c+dx)}{x^5} dx$$
$$= \frac{((a^2(-i\,\Gamma(-4,i\,dx)+i\,\Gamma(-4,-i\,dx))\cos(c)-a^2(\Gamma(-4,i\,dx)+\Gamma(-4,-i\,dx))\sin(c))d^7-48\,(ab(\Gamma(-4,i}{}$$

input
```
integrate((b*x^3+a)^2*sin(d*x+c)/x^5,x, algorithm="maxima")
```

output
```
1/2*(((a^2*(-I*gamma(-4, I*d*x) + I*gamma(-4, -I*d*x))*cos(c) - a^2*(gamma
(-4, I*d*x) + gamma(-4, -I*d*x))*sin(c))*d^7 - 48*(a*b*(gamma(-4, I*d*x) +
 gamma(-4, -I*d*x))*cos(c) + a*b*(-I*gamma(-4, I*d*x) + I*gamma(-4, -I*d*x
))*sin(c))*d^4)*x^4 - 2*(b^2*d^2*x^5 + 2*a*b*d^2*x^2 - 12*a*b)*cos(d*x + c
) + 2*(b^2*d*x^4 - 4*a*b*d*x)*sin(d*x + c))/(d^3*x^4)
```

### 3.93.8 Giac [C] (verification not implemented)

Result contains higher order function than in optimal. Order 9 vs. order 4.

Time = 0.31 (sec) , antiderivative size = 1255, normalized size of antiderivative = 7.51

$$\int \frac{(a+bx^3)^2 \sin(c+dx)}{x^5} dx = \text{Too large to display}$$

input
```
integrate((b*x^3+a)^2*sin(d*x+c)/x^5,x, algorithm="giac")
```

output
```
-1/48*(a^2*d^6*x^4*imag_part(cos_integral(d*x))*tan(1/2*d*x)^2*tan(1/2*c)^
2 - a^2*d^6*x^4*imag_part(cos_integral(-d*x))*tan(1/2*d*x)^2*tan(1/2*c)^2
+ 2*a^2*d^6*x^4*sin_integral(d*x)*tan(1/2*d*x)^2*tan(1/2*c)^2 - 2*a^2*d^6*
x^4*real_part(cos_integral(d*x))*tan(1/2*d*x)^2*tan(1/2*c) - 2*a^2*d^6*x^4
*real_part(cos_integral(-d*x))*tan(1/2*d*x)^2*tan(1/2*c) - a^2*d^6*x^4*ima
g_part(cos_integral(d*x))*tan(1/2*d*x)^2 + a^2*d^6*x^4*imag_part(cos_integ
ral(-d*x))*tan(1/2*d*x)^2 - 2*a^2*d^6*x^4*sin_integral(d*x)*tan(1/2*d*x)^2
 + a^2*d^6*x^4*imag_part(cos_integral(d*x))*tan(1/2*c)^2 - a^2*d^6*x^4*ima
g_part(cos_integral(-d*x))*tan(1/2*c)^2 + 2*a^2*d^6*x^4*sin_integral(d*x)*
tan(1/2*c)^2 - 2*a^2*d^6*x^4*real_part(cos_integral(d*x))*tan(1/2*c) - 2*a
^2*d^6*x^4*real_part(cos_integral(-d*x))*tan(1/2*c) - 2*a^2*d^5*x^3*tan(1/
2*d*x)^2*tan(1/2*c)^2 + 48*a*b*d^3*x^4*real_part(cos_integral(d*x))*tan(1/
2*d*x)^2*tan(1/2*c)^2 + 48*a*b*d^3*x^4*real_part(cos_integral(-d*x))*tan(1
/2*d*x)^2*tan(1/2*c)^2 - a^2*d^6*x^4*imag_part(cos_integral(d*x)) + a^2*d^
6*x^4*imag_part(cos_integral(-d*x)) - 2*a^2*d^6*x^4*sin_integral(d*x) + 96
*a*b*d^3*x^4*imag_part(cos_integral(d*x))*tan(1/2*d*x)^2*tan(1/2*c) - 96*a
*b*d^3*x^4*imag_part(cos_integral(-d*x))*tan(1/2*d*x)^2*tan(1/2*c) + 192*a
*b*d^3*x^4*sin_integral(d*x)*tan(1/2*d*x)^2*tan(1/2*c) + 2*a^2*d^5*x^3*tan
(1/2*d*x)^2 - 48*a*b*d^3*x^4*real_part(cos_integral(d*x))*tan(1/2*d*x)^2 -
 48*a*b*d^3*x^4*real_part(cos_integral(-d*x))*tan(1/2*d*x)^2 + 8*a^2*d^...
```

### 3.93.9 Mupad [F(-1)]

Timed out.

$$\int \frac{(a+bx^3)^2\sin(c+dx)}{x^5}\,dx = \int \frac{\sin(c+d\,x)\,\left(b\,x^3+a\right)^2}{x^5}\,dx$$

input
```
int((sin(c + d*x)*(a + b*x^3)^2)/x^5,x)
```

output
```
int((sin(c + d*x)*(a + b*x^3)^2)/x^5, x)
```

# 3.94 $\int \frac{x^4\sin(c+dx)}{a+bx^3}\,dx$



## 3.94.1 Optimal result

Integrand size = 19, antiderivative size = 371

$$\begin{aligned}
\int \frac{x^4\sin(c+dx)}{a+bx^3}\,dx = & -\frac{x\cos(c+dx)}{bd}+\frac{a^{2/3}\operatorname{CosIntegral}\left(\frac{\sqrt[3]{a}d}{\sqrt[3]{b}}+dx\right)\sin\left(c-\frac{\sqrt[3]{a}d}{\sqrt[3]{b}}\right)}{3b^{5/3}} \\
& +\frac{(-1)^{2/3}a^{2/3}\operatorname{CosIntegral}\left(\frac{\sqrt[3]{-1}\sqrt[3]{a}d}{\sqrt[3]{b}}-dx\right)\sin\left(c+\frac{\sqrt[3]{-1}\sqrt[3]{a}d}{\sqrt[3]{b}}\right)}{3b^{5/3}} \\
& -\frac{\sqrt[3]{-1}a^{2/3}\operatorname{CosIntegral}\left(\frac{(-1)^{2/3}\sqrt[3]{a}d}{\sqrt[3]{b}}+dx\right)\sin\left(c-\frac{(-1)^{2/3}\sqrt[3]{a}d}{\sqrt[3]{b}}\right)}{3b^{5/3}} \\
& +\frac{\sin(c+dx)}{bd^2} \\
& -\frac{(-1)^{2/3}a^{2/3}\cos\left(c+\frac{\sqrt[3]{-1}\sqrt[3]{a}d}{\sqrt[3]{b}}\right)\operatorname{Si}\left(\frac{\sqrt[3]{-1}\sqrt[3]{a}d}{\sqrt[3]{b}}-dx\right)}{3b^{5/3}} \\
& +\frac{a^{2/3}\cos\left(c-\frac{\sqrt[3]{a}d}{\sqrt[3]{b}}\right)\operatorname{Si}\left(\frac{\sqrt[3]{a}d}{\sqrt[3]{b}}+dx\right)}{3b^{5/3}} \\
& -\frac{\sqrt[3]{-1}a^{2/3}\cos\left(c-\frac{(-1)^{2/3}\sqrt[3]{a}d}{\sqrt[3]{b}}\right)\operatorname{Si}\left(\frac{(-1)^{2/3}\sqrt[3]{a}d}{\sqrt[3]{b}}+dx\right)}{3b^{5/3}}
\end{aligned}$$

output
```
-x*cos(d*x+c)/b/d+1/3*(-1)^(2/3)*a^(2/3)*cos(c+(-1)^(1/3)*a^(1/3)*d/b^(1/3
))*Si(-(-1)^(1/3)*a^(1/3)*d/b^(1/3)+d*x)/b^(5/3)+1/3*a^(2/3)*cos(c-a^(1/3)
*d/b^(1/3))*Si(a^(1/3)*d/b^(1/3)+d*x)/b^(5/3)-1/3*(-1)^(1/3)*a^(2/3)*cos(c
-(-1)^(2/3)*a^(1/3)*d/b^(1/3))*Si((-1)^(2/3)*a^(1/3)*d/b^(1/3)+d*x)/b^(5/3
)+1/3*a^(2/3)*Ci(a^(1/3)*d/b^(1/3)+d*x)*sin(c-a^(1/3)*d/b^(1/3))/b^(5/3)+1
/3*(-1)^(2/3)*a^(2/3)*Ci((-1)^(1/3)*a^(1/3)*d/b^(1/3)-d*x)*sin(c+(-1)^(1/3
)*a^(1/3)*d/b^(1/3))/b^(5/3)-1/3*(-1)^(1/3)*a^(2/3)*Ci((-1)^(2/3)*a^(1/3)*
d/b^(1/3)+d*x)*sin(c-(-1)^(2/3)*a^(1/3)*d/b^(1/3))/b^(5/3)+sin(d*x+c)/b/d^
2
```

### 3.94.2 Mathematica [C] (verified)

Result contains higher order function than in optimal. Order 9 vs. order 4 in optimal.

Time = 0.14 (sec) , antiderivative size = 231, normalized size of antiderivative = 0.62

$$\int \frac{x^4 \sin(c+dx)}{a+bx^3} \, dx$$
$$= \frac{-iad^2\text{RootSum}\Big[a+b\#1^3\&, \frac{\cos(c+d\#1)\,\text{CosIntegral}(d(x-\#1))-i\,\text{CosIntegral}(d(x-\#1))\sin(c+d\#1)-i\cos(c+d\#1)\text{Si}(d(x-}{\#1}}{}$$

input
```
Integrate[(x^4*Sin[c + d*x])/(a + b*x^3),x]
```

output
```
((-I)*a*d^2*RootSum[a + b*#1^3 & , (Cos[c + d*#1]*CosIntegral[d*(x - #1)]
- I*CosIntegral[d*(x - #1)]*Sin[c + d*#1] - I*Cos[c + d*#1]*SinIntegral[d*
(x - #1)] - Sin[c + d*#1]*SinIntegral[d*(x - #1)])/#1 & ] + I*a*d^2*RootSu
m[a + b*#1^3 & , (Cos[c + d*#1]*CosIntegral[d*(x - #1)] + I*CosIntegral[d*
(x - #1)]*Sin[c + d*#1] + I*Cos[c + d*#1]*SinIntegral[d*(x - #1)] - Sin[c
+ d*#1]*SinIntegral[d*(x - #1)])/#1 & ] + 6*b*(-(d*x*Cos[c + d*x]) + Sin[c
 + d*x]))/(6*b^2*d^2)
```

### 3.94.3 Rubi [A] (verified)

Time = 1.01 (sec) , antiderivative size = 371, normalized size of antiderivative = 1.00, number of steps used = 2, number of rules used = 2, $\frac{\text{number of rules}}{\text{integrand size}}$ = 0.105, Rules used = {3826, 2009}

Below are the steps used by Rubi to obtain the solution. The rule number used for the transformation is given above next to the arrow. The rules definitions used are listed below.

$$\int \frac{x^4 \sin(c+dx)}{a+bx^3} \, dx$$

$$\Big\downarrow \text{3826}$$

$$\int \left(\frac{x \sin(c+dx)}{b}-\frac{ax \sin(c+dx)}{b\left(a+bx^3\right)}\right)dx$$

$$\Big\downarrow \text{2009}$$

$$\frac{a^{2/3} \sin\left(c-\frac{\sqrt[3]{a}d}{\sqrt[3]{b}}\right) \text{CosIntegral}\left(xd+\frac{\sqrt[3]{a}d}{\sqrt[3]{b}}\right)}{3b^{5/3}}+\frac{(-1)^{2/3}a^{2/3} \sin\left(\frac{\sqrt[3]{-1}\sqrt[3]{a}d}{\sqrt[3]{b}}+c\right) \text{CosIntegral}\left(\frac{\sqrt[3]{-1}\sqrt[3]{a}d}{\sqrt[3]{b}}-dx\right)}{3b^{5/3}}-\frac{\sqrt[3]{-1}a^{2/3} \sin\left(c-\frac{(-1)^{2/3}\sqrt[3]{a}d}{\sqrt[3]{b}}\right) \text{CosIntegral}\left(xd+\frac{(-1)^{2/3}\sqrt[3]{a}d}{\sqrt[3]{b}}\right)}{3b^{5/3}}-\frac{(-1)^{2/3}a^{2/3} \cos\left(\frac{\sqrt[3]{-1}\sqrt[3]{a}d}{\sqrt[3]{b}}+c\right) \text{Si}\left(\frac{\sqrt[3]{-1}\sqrt[3]{a}d}{\sqrt[3]{b}}-dx\right)}{3b^{5/3}}+\frac{a^{2/3} \cos\left(c-\frac{\sqrt[3]{a}d}{\sqrt[3]{b}}\right) \text{Si}\left(xd+\frac{\sqrt[3]{a}d}{\sqrt[3]{b}}\right)}{3b^{5/3}}-\frac{\sqrt[3]{-1}a^{2/3} \cos\left(c-\frac{(-1)^{2/3}\sqrt[3]{a}d}{\sqrt[3]{b}}\right) \text{Si}\left(xd+\frac{(-1)^{2/3}\sqrt[3]{a}d}{\sqrt[3]{b}}\right)}{3b^{5/3}}+\frac{\sin(c+dx)}{bd^2}-\frac{x \cos(c+dx)}{bd}$$

input
```
Int[(x^4*Sin[c + d*x])/(a + b*x^3),x]
```

output
```
-((x*Cos[c + d*x])/(b*d)) + (a^(2/3)*CosIntegral[(a^(1/3)*d)/b^(1/3) + d*x
]*Sin[c - (a^(1/3)*d)/b^(1/3)])/(3*b^(5/3)) + ((-1)^(2/3)*a^(2/3)*CosInteg
ral[((-1)^(1/3)*a^(1/3)*d)/b^(1/3) - d*x]*Sin[c + ((-1)^(1/3)*a^(1/3)*d)/b
^(1/3)])/(3*b^(5/3)) - ((-1)^(1/3)*a^(2/3)*CosIntegral[((-1)^(2/3)*a^(1/3)
*d)/b^(1/3) + d*x]*Sin[c - ((-1)^(2/3)*a^(1/3)*d)/b^(1/3)])/(3*b^(5/3)) +
Sin[c + d*x]/(b*d^2) - ((-1)^(2/3)*a^(2/3)*Cos[c + ((-1)^(1/3)*a^(1/3)*d)/
b^(1/3)]*SinIntegral[((-1)^(1/3)*a^(1/3)*d)/b^(1/3) - d*x])/(3*b^(5/3)) +
(a^(2/3)*Cos[c - (a^(1/3)*d)/b^(1/3)]*SinIntegral[(a^(1/3)*d)/b^(1/3) + d*
x])/(3*b^(5/3)) - ((-1)^(1/3)*a^(2/3)*Cos[c - ((-1)^(2/3)*a^(1/3)*d)/b^(1/
3)]*SinIntegral[((-1)^(2/3)*a^(1/3)*d)/b^(1/3) + d*x])/(3*b^(5/3))
```

### 3.94.3.1 Defintions of rubi rules used

rule 2009
```
Int[u_, x_Symbol] :> Simp[IntSum[u, x], x] /; SumQ[u]
```

rule 3826
```
Int[(x_)^(m_.)*((a_) + (b_.)*(x_)^(n_))^(p_)*Sin[(c_.) + (d_.)*(x_)], x_Sym
bol] :> Int[ExpandIntegrand[Sin[c + d*x], x^m*(a + b*x^n)^p, x], x] /; Free
Q[{a, b, c, d, m}, x] && ILtQ[p, 0] && IGtQ[n, 0] && (EqQ[n, 2] || EqQ[p, -
1]) && IntegerQ[m]
```

## 3.94.4 Maple [C] (verified)

Result contains higher order function than in optimal. Order 9 vs. order 4.

Time = 0.40 (sec) , antiderivative size = 558, normalized size of antiderivative = 1.50

| method | result |
|---|---|
| derivativedivides | $\frac{d^3 c^4 \left(\sum_{\_R1=\mathrm{RootOf}\left(b\_Z^3-3\_Z^2bc+3c^2b\_Z+a\,d^3-c^3b\right)} \frac{-\mathrm{Si}\left(-dx+\_R1-c\right)\cos\left(\_R1\right)+\mathrm{Ci}\left(dx-\_R1+c\right)\sin\left(\_R1\right)}{\_R1^2-2\_R1c+c^2}\right.}{3b}$ |
| default | $\frac{d^3 c^4 \left(\sum_{\_R1=\mathrm{RootOf}\left(b\_Z^3-3\_Z^2bc+3c^2b\_Z+a\,d^3-c^3b\right)} \frac{-\mathrm{Si}\left(-dx+\_R1-c\right)\cos\left(\_R1\right)+\mathrm{Ci}\left(dx-\_R1+c\right)\sin\left(\_R1\right)}{\_R1^2-2\_R1c+c^2}\right.}{3b}$ |
| risch | Expression too large to display |

input
```
int(x^4*sin(d*x+c)/(b*x^3+a),x,method=_RETURNVERBOSE)
```

output
```
1/d^5*(1/3*d^3*c^4/b*sum(1/(_R1^2-2*_R1*c+c^2)*(-Si(-d*x+_R1-c)*cos(_R1)+C
i(d*x-_R1+c)*sin(_R1)),_R1=RootOf(_Z^3*b-3*_Z^2*b*c+3*_Z*b*c^2+a*d^3-b*c^3
))-4/3*d^3*c^3/b*sum(_R1/(_R1^2-2*_R1*c+c^2)*(-Si(-d*x+_R1-c)*cos(_R1)+Ci(
d*x-_R1+c)*sin(_R1)),_R1=RootOf(_Z^3*b-3*_Z^2*b*c+3*_Z*b*c^2+a*d^3-b*c^3))
+2*d^3*c^2/b*sum(_R1^2/(_R1^2-2*_R1*c+c^2)*(-Si(-d*x+_R1-c)*cos(_R1)+Ci(d*
x-_R1+c)*sin(_R1)),_R1=RootOf(_Z^3*b-3*_Z^2*b*c+3*_Z*b*c^2+a*d^3-b*c^3))+4
*d^3*c/b*cos(d*x+c)+4/3/b^2*d^3*c*sum((-3*_R1^2*b*c+3*_R1*b*c^2+a*d^3-b*c^
3)/(_R1^2-2*_R1*c+c^2)*(-Si(-d*x+_R1-c)*cos(_R1)+Ci(d*x-_R1+c)*sin(_R1)),_
R1=RootOf(_Z^3*b-3*_Z^2*b*c+3*_Z*b*c^2+a*d^3-b*c^3))+(-3*cos(d*x+c)*d^3*c+
d^3*(sin(d*x+c)-cos(d*x+c)*(d*x+c)))/b-1/3/b^2*d^3*sum((-6*_R1^2*b*c^2+_R1
*a*d^3+8*_R1*b*c^3+3*a*c*d^3-3*b*c^4)/(_R1^2-2*_R1*c+c^2)*(-Si(-d*x+_R1-c)
*cos(_R1)+Ci(d*x-_R1+c)*sin(_R1)),_R1=RootOf(_Z^3*b-3*_Z^2*b*c+3*_Z*b*c^2+
a*d^3-b*c^3)))
```

### 3.94.5 Fricas [C] (verification not implemented)

Result contains complex when optimal does not.

Time = 0.32 (sec) , antiderivative size = 397, normalized size of antiderivative = 1.07

$$\int \frac{x^4\sin(c+dx)}{a+bx^3}\,dx = \frac{\left(\frac{iad^3}{b}\right)^{\frac{2}{3}}(\sqrt{3}+i)\mathrm{Ei}\left(-i\,dx+\frac{1}{2}\left(\frac{iad^3}{b}\right)^{\frac{1}{3}}\left(-i\sqrt{3}-1\right)\right)e^{\left(\frac{1}{2}\left(\frac{iad^3}{b}\right)^{\frac{1}{3}}\left(i\sqrt{3}+1\right)-ic\right)}-\left(-\frac{iad^3}{b}\right)^{\frac{2}{3}}(\sqrt{3}+i)\mathrm{Ei}\Big(}{}$$

input
```
integrate(x^4*sin(d*x+c)/(b*x^3+a),x, algorithm="fricas")
```

output
```
1/12*((I*a*d^3/b)^(2/3)*(sqrt(3) + I)*Ei(-I*d*x + 1/2*(I*a*d^3/b)^(1/3)*(-
I*sqrt(3) - 1))*e^(1/2*(I*a*d^3/b)^(1/3)*(I*sqrt(3) + 1) - I*c) - (-I*a*d^
3/b)^(2/3)*(sqrt(3) + I)*Ei(I*d*x + 1/2*(-I*a*d^3/b)^(1/3)*(-I*sqrt(3) - 1
))*e^(1/2*(-I*a*d^3/b)^(1/3)*(I*sqrt(3) + 1) + I*c) - (I*a*d^3/b)^(2/3)*(s
qrt(3) - I)*Ei(-I*d*x + 1/2*(I*a*d^3/b)^(1/3)*(I*sqrt(3) - 1))*e^(1/2*(I*a
*d^3/b)^(1/3)*(-I*sqrt(3) + 1) - I*c) + (-I*a*d^3/b)^(2/3)*(sqrt(3) - I)*E
i(I*d*x + 1/2*(-I*a*d^3/b)^(1/3)*(I*sqrt(3) - 1))*e^(1/2*(-I*a*d^3/b)^(1/3
)*(-I*sqrt(3) + 1) + I*c) - 12*d*x*cos(d*x + c) + 2*I*(-I*a*d^3/b)^(2/3)*E
i(I*d*x + (-I*a*d^3/b)^(1/3))*e^(I*c - (-I*a*d^3/b)^(1/3)) - 2*I*(I*a*d^3/
b)^(2/3)*Ei(-I*d*x + (I*a*d^3/b)^(1/3))*e^(-I*c - (I*a*d^3/b)^(1/3)) + 12*
sin(d*x + c))/(b*d^2)
```

### 3.94.6 Sympy [F]

$$\int \frac{x^4 \sin(c+dx)}{a+bx^3} \, dx = \int \frac{x^4 \sin{(c+dx)}}{a+bx^3} \, dx$$

input
```
integrate(x**4*sin(d*x+c)/(b*x**3+a),x)
```

output
```
Integral(x**4*sin(c + d*x)/(a + b*x**3), x)
```

### 3.94.7 Maxima [F]

$$\int \frac{x^4 \sin(c+dx)}{a+bx^3} \, dx = \int \frac{x^4 \sin{(dx+c)}}{bx^3+a} \, dx$$

input
```
integrate(x^4*sin(d*x+c)/(b*x^3+a),x, algorithm="maxima")
```

output
```
-1/2*((cos(c)^2 + sin(c)^2)*d*x^4*cos(d*x + c) - (cos(c)^2 + sin(c)^2)*x^3
*sin(d*x + c) + ((d*x^4*cos(c) + x^3*sin(c))*cos(d*x + c)^2 + (d*x^4*cos(c
) + x^3*sin(c))*sin(d*x + c)^2)*cos(d*x + 2*c) + 2*(((b*cos(c)^2 + b*sin(c
)^2)*d^2*x^3 + (a*cos(c)^2 + a*sin(c)^2)*d^2)*cos(d*x + c)^2 + ((b*cos(c)^
2 + b*sin(c)^2)*d^2*x^3 + (a*cos(c)^2 + a*sin(c)^2)*d^2)*sin(d*x + c)^2)*i
ntegrate(-3/2*(a*d*x^3*cos(d*x + c) - a*x^2*sin(d*x + c))/(b^2*d^2*x^6 + 2
*a*b*d^2*x^3 + a^2*d^2), x) + 2*(((b*cos(c)^2 + b*sin(c)^2)*d^2*x^3 + (a*c
os(c)^2 + a*sin(c)^2)*d^2)*cos(d*x + c)^2 + ((b*cos(c)^2 + b*sin(c)^2)*d^2
*x^3 + (a*cos(c)^2 + a*sin(c)^2)*d^2)*sin(d*x + c)^2)*integrate(-3/2*(a*d*
x^3*cos(d*x + c) - a*x^2*sin(d*x + c))/((b^2*d^2*x^6 + 2*a*b*d^2*x^3 + a^2
*d^2)*cos(d*x + c)^2 + (b^2*d^2*x^6 + 2*a*b*d^2*x^3 + a^2*d^2)*sin(d*x + c
)^2), x) + ((d*x^4*sin(c) - x^3*cos(c))*cos(d*x + c)^2 + (d*x^4*sin(c) - x
^3*cos(c))*sin(d*x + c)^2)*sin(d*x + 2*c))/(((b*cos(c)^2 + b*sin(c)^2)*d^2
*x^3 + (a*cos(c)^2 + a*sin(c)^2)*d^2)*cos(d*x + c)^2 + ((b*cos(c)^2 + b*si
n(c)^2)*d^2*x^3 + (a*cos(c)^2 + a*sin(c)^2)*d^2)*sin(d*x + c)^2)
```

### 3.94.8 Giac [F]

$$\int \frac{x^4 \sin(c+dx)}{a+bx^3} \, dx = \int \frac{x^4 \sin(dx+c)}{bx^3+a} \, dx$$

input
```
integrate(x^4*sin(d*x+c)/(b*x^3+a),x, algorithm="giac")
```

output
```
integrate(x^4*sin(d*x + c)/(b*x^3 + a), x)
```

### 3.94.9 Mupad [F(-1)]

Timed out.

$$\int \frac{x^4 \sin(c+dx)}{a+bx^3} \, dx = \int \frac{x^4 \sin(c+d\,x)}{b\,x^3+a} \, dx$$

input
```
int((x^4*sin(c + d*x))/(a + b*x^3),x)
```

output
```
int((x^4*sin(c + d*x))/(a + b*x^3), x)
```

# 3.95 $\int \frac{x^3 \sin(c+dx)}{a+bx^3} dx$



## 3.95.1 Optimal result

Integrand size = 19, antiderivative size = 357

$$\int \frac{x^3 \sin(c+dx)}{a+bx^3} dx = -\frac{\cos(c+dx)}{bd} - \frac{\sqrt[3]{a}\,\text{CosIntegral}\left(\frac{\sqrt[3]{a}d}{\sqrt[3]{b}}+dx\right)\sin\left(c-\frac{\sqrt[3]{a}d}{\sqrt[3]{b}}\right)}{3b^{4/3}}$$
$$+ \frac{\sqrt[3]{-1}\sqrt[3]{a}\,\text{CosIntegral}\left(\frac{\sqrt[3]{-1}\sqrt[3]{a}d}{\sqrt[3]{b}}-dx\right)\sin\left(c+\frac{\sqrt[3]{-1}\sqrt[3]{a}d}{\sqrt[3]{b}}\right)}{3b^{4/3}}$$
$$- \frac{(-1)^{2/3}\sqrt[3]{a}\,\text{CosIntegral}\left(\frac{(-1)^{2/3}\sqrt[3]{a}d}{\sqrt[3]{b}}+dx\right)\sin\left(c-\frac{(-1)^{2/3}\sqrt[3]{a}d}{\sqrt[3]{b}}\right)}{3b^{4/3}}$$
$$- \frac{\sqrt[3]{-1}\sqrt[3]{a}\cos\left(c+\frac{\sqrt[3]{-1}\sqrt[3]{a}d}{\sqrt[3]{b}}\right)\text{Si}\left(\frac{\sqrt[3]{-1}\sqrt[3]{a}d}{\sqrt[3]{b}}-dx\right)}{3b^{4/3}}$$
$$- \frac{\sqrt[3]{a}\cos\left(c-\frac{\sqrt[3]{a}d}{\sqrt[3]{b}}\right)\text{Si}\left(\frac{\sqrt[3]{a}d}{\sqrt[3]{b}}+dx\right)}{3b^{4/3}}$$
$$- \frac{(-1)^{2/3}\sqrt[3]{a}\cos\left(c-\frac{(-1)^{2/3}\sqrt[3]{a}d}{\sqrt[3]{b}}\right)\text{Si}\left(\frac{(-1)^{2/3}\sqrt[3]{a}d}{\sqrt[3]{b}}+dx\right)}{3b^{4/3}}$$

output
```
-cos(d*x+c)/b/d+1/3*(-1)^(1/3)*a^(1/3)*cos(c+(-1)^(1/3)*a^(1/3)*d/b^(1/3))
*Si(-(-1)^(1/3)*a^(1/3)*d/b^(1/3)+d*x)/b^(4/3)-1/3*a^(1/3)*cos(c-a^(1/3)*d
/b^(1/3))*Si(a^(1/3)*d/b^(1/3)+d*x)/b^(4/3)-1/3*(-1)^(2/3)*a^(1/3)*cos(c-(
-1)^(2/3)*a^(1/3)*d/b^(1/3))*Si((-1)^(2/3)*a^(1/3)*d/b^(1/3)+d*x)/b^(4/3)-
1/3*a^(1/3)*Ci(a^(1/3)*d/b^(1/3)+d*x)*sin(c-a^(1/3)*d/b^(1/3))/b^(4/3)+1/3
*(-1)^(1/3)*a^(1/3)*Ci((-1)^(1/3)*a^(1/3)*d/b^(1/3)-d*x)*sin(c+(-1)^(1/3)*
a^(1/3)*d/b^(1/3))/b^(4/3)-1/3*(-1)^(2/3)*a^(1/3)*Ci((-1)^(2/3)*a^(1/3)*d/
b^(1/3)+d*x)*sin(c-(-1)^(2/3)*a^(1/3)*d/b^(1/3))/b^(4/3)
```

### 3.95.2 Mathematica [C] (verified)

Result contains higher order function than in optimal. Order 9 vs. order 4 in optimal.

Time = 0.11 (sec) , antiderivative size = 216, normalized size of antiderivative = 0.61

$$\int \frac{x^3\sin(c+dx)}{a+bx^3}\,dx =$$

$$-\frac{6b\cos(c+dx)+iad\text{RootSum}\left[a+b\#1^3\&,\frac{\cos(c+d\#1)\,\text{CosIntegral}(d(x-\#1))-i\,\text{CosIntegral}(d(x-\#1))\sin(c+d\#1)-i}{\#1^2}\right.}{}$$

input
```
Integrate[(x^3*Sin[c + d*x])/(a + b*x^3),x]
```

output
```
-1/6*(6*b*Cos[c + d*x] + I*a*d*RootSum[a + b*#1^3 & , (Cos[c + d*#1]*CosIn
tegral[d*(x - #1)] - I*CosIntegral[d*(x - #1)]*Sin[c + d*#1] - I*Cos[c + d
*#1]*SinIntegral[d*(x - #1)] - Sin[c + d*#1]*SinIntegral[d*(x - #1)])/#1^2
 & ] - I*a*d*RootSum[a + b*#1^3 & , (Cos[c + d*#1]*CosIntegral[d*(x - #1)]
 + I*CosIntegral[d*(x - #1)]*Sin[c + d*#1] + I*Cos[c + d*#1]*SinIntegral[d
*(x - #1)] - Sin[c + d*#1]*SinIntegral[d*(x - #1)])/#1^2 & ])/(b^2*d)
```

### 3.95.3 Rubi [A] (verified)

Time = 0.82 (sec) , antiderivative size = 357, normalized size of antiderivative = 1.00, number of steps used = 2, number of rules used = 2, $\frac{\text{number of rules}}{\text{integrand size}}$ = 0.105, Rules used = {3826, 2009}

Below are the steps used by Rubi to obtain the solution. The rule number used for the transformation is given above next to the arrow. The rules definitions used are listed below.

$$\int \frac{x^3\sin(c+dx)}{a+bx^3}\,dx$$
$$\Big\downarrow \ 3826$$
$$\int \left(\frac{\sin(c+dx)}{b}-\frac{a\sin(c+dx)}{b\,(a+bx^3)}\right)dx$$
$$\Big\downarrow \ 2009$$
$$-\frac{\sqrt[3]{a}\sin\left(c-\frac{\sqrt[3]{a}d}{\sqrt[3]{b}}\right)\text{CosIntegral}\left(xd+\frac{\sqrt[3]{a}d}{\sqrt[3]{b}}\right)}{3b^{4/3}}+\frac{\sqrt[3]{-1}\sqrt[3]{a}\sin\left(\frac{\sqrt[3]{-1}\sqrt[3]{a}d}{\sqrt[3]{b}}+c\right)\text{CosIntegral}\left(\frac{\sqrt[3]{-1}\sqrt[3]{a}d}{\sqrt[3]{b}}-dx\right)}{3b^{4/3}}-\frac{(-1)^{2/3}\sqrt[3]{a}\sin\left(c-\frac{(-1)^{2/3}\sqrt[3]{a}d}{\sqrt[3]{b}}\right)\text{CosIntegral}\left(xd+\frac{(-1)^{2/3}\sqrt[3]{a}d}{\sqrt[3]{b}}\right)}{3b^{4/3}}-\frac{\sqrt[3]{-1}\sqrt[3]{a}\cos\left(\frac{\sqrt[3]{-1}\sqrt[3]{a}d}{\sqrt[3]{b}}+c\right)\text{Si}\left(\frac{\sqrt[3]{-1}\sqrt[3]{a}d}{\sqrt[3]{b}}-dx\right)}{3b^{4/3}}-\frac{\sqrt[3]{a}\cos\left(c-\frac{\sqrt[3]{a}d}{\sqrt[3]{b}}\right)\text{Si}\left(xd+\frac{\sqrt[3]{a}d}{\sqrt[3]{b}}\right)}{3b^{4/3}}-\frac{(-1)^{2/3}\sqrt[3]{a}\cos\left(c-\frac{(-1)^{2/3}\sqrt[3]{a}d}{\sqrt[3]{b}}\right)\text{Si}\left(xd+\frac{(-1)^{2/3}\sqrt[3]{a}d}{\sqrt[3]{b}}\right)}{3b^{4/3}}-\frac{\cos(c+dx)}{bd}$$

input
```
Int[(x^3*Sin[c + d*x])/(a + b*x^3),x]
```

output
```
-(Cos[c + d*x]/(b*d)) - (a^(1/3)*CosIntegral[(a^(1/3)*d)/b^(1/3) + d*x]*Si
n[c - (a^(1/3)*d)/b^(1/3)])/(3*b^(4/3)) + ((-1)^(1/3)*a^(1/3)*CosIntegral[
((-1)^(1/3)*a^(1/3)*d)/b^(1/3) - d*x]*Sin[c + ((-1)^(1/3)*a^(1/3)*d)/b^(1/
3)])/(3*b^(4/3)) - ((-1)^(2/3)*a^(1/3)*CosIntegral[((-1)^(2/3)*a^(1/3)*d)/
b^(1/3) + d*x]*Sin[c - ((-1)^(2/3)*a^(1/3)*d)/b^(1/3)])/(3*b^(4/3)) - ((-1
)^(1/3)*a^(1/3)*Cos[c + ((-1)^(1/3)*a^(1/3)*d)/b^(1/3)]*SinIntegral[((-1)^
(1/3)*a^(1/3)*d)/b^(1/3) - d*x])/(3*b^(4/3)) - (a^(1/3)*Cos[c - (a^(1/3)*d
)/b^(1/3)]*SinIntegral[(a^(1/3)*d)/b^(1/3) + d*x])/(3*b^(4/3)) - ((-1)^(2/
3)*a^(1/3)*Cos[c - ((-1)^(2/3)*a^(1/3)*d)/b^(1/3)]*SinIntegral[((-1)^(2/3)
*a^(1/3)*d)/b^(1/3) + d*x])/(3*b^(4/3))
```

## 3.95. $\int \frac{x^3\sin(c+dx)}{a+bx^3}\,dx$

#### 3.95.3.1 Defintions of rubi rules used

rule 2009
```
Int[u_, x_Symbol] :> Simp[IntSum[u, x], x] /; SumQ[u]
```

rule 3826
```
Int[(x_)^(m_.)*((a_) + (b_.)*(x_)^(n_))^(p_)*Sin[(c_.) + (d_.)*(x_)], x_Sym
bol] :> Int[ExpandIntegrand[Sin[c + d*x], x^m*(a + b*x^n)^p, x], x] /; Free
Q[{a, b, c, d, m}, x] && ILtQ[p, 0] && IGtQ[n, 0] && (EqQ[n, 2] || EqQ[p, -
1]) && IntegerQ[m]
```

### 3.95.4 Maple [C] (verified)

Result contains higher order function than in optimal. Order 9 vs. order 4.

Time = 0.37 (sec) , antiderivative size = 392, normalized size of antiderivative = 1.10

| method | result |
|---|---|
| derivativedivides | $-\frac{d^3c^3\left(\sum_{\_R1=\mathrm{RootOf}\left(b\_Z^3-3\_Z^2bc+3c^2b\_Z+a\,d^3-c^3b\right)}\frac{-\mathrm{Si}\left(-dx+\_R1-c\right)\cos\left(\_R1\right)+\mathrm{Ci}\left(dx-\_R1+c\right)\sin\left(\_R\right.}{\_R1^2-2\_R1c+c^2}\right.}{3b}$ |
| default | $-\frac{d^3c^3\left(\sum_{\_R1=\mathrm{RootOf}\left(b\_Z^3-3\_Z^2bc+3c^2b\_Z+a\,d^3-c^3b\right)}\frac{-\mathrm{Si}\left(-dx+\_R1-c\right)\cos\left(\_R1\right)+\mathrm{Ci}\left(dx-\_R1+c\right)\sin\left(\_R\right.}{\_R1^2-2\_R1c+c^2}\right.}{3b}$ |
| risch | $\frac{i\left(\sum_{\_R1=\mathrm{RootOf}\left(-3i\_Z^2bc-id^3a+ib\,c^3+b\_Z^3-3c^2b\_Z\right)}\frac{e^{\_R1}\,\mathrm{Ei}_1\left(-idx-ic+\_R1\right)}{-2ic\_R1+\_R1^2-c^2}\right)c^3}{6db}-\frac{i\left(\sum_{\_R1=\mathrm{RootOf}\left(-3i\_Z^2bc\right.}\right.}{}$ |

input
```
int(x^3*sin(d*x+c)/(b*x^3+a),x,method=_RETURNVERBOSE)
```

output
```
1/d^4*(-1/3*d^3*c^3/b*sum(1/(_R1^2-2*_R1*c+c^2)*(-Si(-d*x+_R1-c)*cos(_R1)+
Ci(d*x-_R1+c)*sin(_R1)),_R1=RootOf(_Z^3*b-3*_Z^2*b*c+3*_Z*b*c^2+a*d^3-b*c^
3))+d^3*c^2/b*sum(_R1/(_R1^2-2*_R1*c+c^2)*(-Si(-d*x+_R1-c)*cos(_R1)+Ci(d*x
-_R1+c)*sin(_R1)),_R1=RootOf(_Z^3*b-3*_Z^2*b*c+3*_Z*b*c^2+a*d^3-b*c^3))-d^
3*c/b*sum(_R1^2/(_R1^2-2*_R1*c+c^2)*(-Si(-d*x+_R1-c)*cos(_R1)+Ci(d*x-_R1+c
)*sin(_R1)),_R1=RootOf(_Z^3*b-3*_Z^2*b*c+3*_Z*b*c^2+a*d^3-b*c^3))-d^3/b*co
s(d*x+c)-1/3/b^2*d^3*sum((-3*_R1^2*b*c+3*_R1*b*c^2+a*d^3-b*c^3)/(_R1^2-2*_
R1*c+c^2)*(-Si(-d*x+_R1-c)*cos(_R1)+Ci(d*x-_R1+c)*sin(_R1)),_R1=RootOf(_Z^
3*b-3*_Z^2*b*c+3*_Z*b*c^2+a*d^3-b*c^3)))
```

### 3.95.5 Fricas [C] (verification not implemented)

Result contains complex when optimal does not.

Time = 0.30 (sec) , antiderivative size = 393, normalized size of antiderivative = 1.10

$$\int \frac{x^3 \sin(c+dx)}{a+bx^3}\,dx$$
$$= \frac{\left(\frac{i a d^3}{b}\right)^{\frac{1}{3}} (-i\sqrt{3}-1)\,\mathrm{Ei}\left(-i dx + \frac{1}{2}\left(\frac{i a d^3}{b}\right)^{\frac{1}{3}}(-i\sqrt{3}-1)\right) e^{\left(\frac{1}{2}\left(\frac{i a d^3}{b}\right)^{\frac{1}{3}}(i\sqrt{3}+1) - i c\right)} + \left(-\frac{i a d^3}{b}\right)^{\frac{1}{3}} (-i\sqrt{3} -}{}$$

input
```
integrate(x^3*sin(d*x+c)/(b*x^3+a),x, algorithm="fricas")
```

output
```
1/12*((I*a*d^3/b)^(1/3)*(-I*sqrt(3) - 1)*Ei(-I*d*x + 1/2*(I*a*d^3/b)^(1/3)
*(-I*sqrt(3) - 1))*e^(1/2*(I*a*d^3/b)^(1/3)*(I*sqrt(3) + 1) - I*c) + (-I*a
*d^3/b)^(1/3)*(-I*sqrt(3) - 1)*Ei(I*d*x + 1/2*(-I*a*d^3/b)^(1/3)*(-I*sqrt(
3) - 1))*e^(1/2*(-I*a*d^3/b)^(1/3)*(I*sqrt(3) + 1) + I*c) + (I*a*d^3/b)^(1
/3)*(I*sqrt(3) - 1)*Ei(-I*d*x + 1/2*(I*a*d^3/b)^(1/3)*(I*sqrt(3) - 1))*e^(
1/2*(I*a*d^3/b)^(1/3)*(-I*sqrt(3) + 1) - I*c) + (-I*a*d^3/b)^(1/3)*(I*sqrt
(3) - 1)*Ei(I*d*x + 1/2*(-I*a*d^3/b)^(1/3)*(I*sqrt(3) - 1))*e^(1/2*(-I*a*d
^3/b)^(1/3)*(-I*sqrt(3) + 1) + I*c) + 2*(-I*a*d^3/b)^(1/3)*Ei(I*d*x + (-I*
a*d^3/b)^(1/3))*e^(I*c - (-I*a*d^3/b)^(1/3)) + 2*(I*a*d^3/b)^(1/3)*Ei(-I*d
*x + (I*a*d^3/b)^(1/3))*e^(-I*c - (I*a*d^3/b)^(1/3)) - 12*cos(d*x + c))/(b
*d)
```

### 3.95.6 Sympy [F]

$$\int \frac{x^3 \sin(c+dx)}{a+bx^3}\,dx = \int \frac{x^3 \sin(c+dx)}{a+bx^3}\,dx$$

input
```
integrate(x**3*sin(d*x+c)/(b*x**3+a),x)
```

output
```
Integral(x**3*sin(c + d*x)/(a + b*x**3), x)
```

### 3.95.7 Maxima [F]

$$\int \frac{x^3 \sin(c+dx)}{a+bx^3} \, dx = \int \frac{x^3 \sin(dx+c)}{bx^3+a} \, dx$$

input
```
integrate(x^3*sin(d*x+c)/(b*x^3+a),x, algorithm="maxima")
```

output
```
-1/2*((cos(c)^2 + sin(c)^2)*x^3*cos(d*x + c) + (x^3*cos(d*x + c)^2*cos(c)
+ x^3*cos(c)*sin(d*x + c)^2)*cos(d*x + 2*c) - 6*(((a*b*cos(c)^2 + a*b*sin(
c)^2)*d*x^3 + (a^2*cos(c)^2 + a^2*sin(c)^2)*d)*cos(d*x + c)^2 + ((a*b*cos(
c)^2 + a*b*sin(c)^2)*d*x^3 + (a^2*cos(c)^2 + a^2*sin(c)^2)*d)*sin(d*x + c)
^2)*integrate(1/2*x^2*cos(d*x + c)/(b^2*d*x^6 + 2*a*b*d*x^3 + a^2*d), x) -
 6*(((a*b*cos(c)^2 + a*b*sin(c)^2)*d*x^3 + (a^2*cos(c)^2 + a^2*sin(c)^2)*d
)*cos(d*x + c)^2 + ((a*b*cos(c)^2 + a*b*sin(c)^2)*d*x^3 + (a^2*cos(c)^2 +
a^2*sin(c)^2)*d)*sin(d*x + c)^2)*integrate(1/2*x^2*cos(d*x + c)/((b^2*d*x^
6 + 2*a*b*d*x^3 + a^2*d)*cos(d*x + c)^2 + (b^2*d*x^6 + 2*a*b*d*x^3 + a^2*d
)*sin(d*x + c)^2), x) + (x^3*cos(d*x + c)^2*sin(c) + x^3*sin(d*x + c)^2*si
n(c))*sin(d*x + 2*c))/(((b*cos(c)^2 + b*sin(c)^2)*d*x^3 + (a*cos(c)^2 + a*
sin(c)^2)*d)*cos(d*x + c)^2 + ((b*cos(c)^2 + b*sin(c)^2)*d*x^3 + (a*cos(c)
^2 + a*sin(c)^2)*d)*sin(d*x + c)^2)
```

### 3.95.8 Giac [F]

$$\int \frac{x^3 \sin(c+dx)}{a+bx^3} \, dx = \int \frac{x^3 \sin(dx+c)}{bx^3+a} \, dx$$

input
```
integrate(x^3*sin(d*x+c)/(b*x^3+a),x, algorithm="giac")
```

output
```
integrate(x^3*sin(d*x + c)/(b*x^3 + a), x)
```

### 3.95.9 Mupad [F(-1)]

Timed out.

$$\int \frac{x^3 \sin(c+dx)}{a+bx^3} \, dx = \int \frac{x^3 \sin(c+d\,x)}{b\,x^3+a} \, dx$$

input
```
int((x^3*sin(c + d*x))/(a + b*x^3),x)
```

output
```
int((x^3*sin(c + d*x))/(a + b*x^3), x)
```

# 3.96 $\int \frac{x^2 \sin(c+dx)}{a+bx^3} dx$



## 3.96.1 Optimal result

Integrand size = 19, antiderivative size = 281

$$\begin{aligned}\int \frac{x^2 \sin(c+dx)}{a+bx^3} dx = & \frac{\text{CosIntegral}\left(\frac{\sqrt[3]{a}d}{\sqrt[3]{b}}+dx\right)\sin\left(c-\frac{\sqrt[3]{a}d}{\sqrt[3]{b}}\right)}{3b} \\ & + \frac{\text{CosIntegral}\left(\frac{\sqrt[3]{-1}\sqrt[3]{a}d}{\sqrt[3]{b}}-dx\right)\sin\left(c+\frac{\sqrt[3]{-1}\sqrt[3]{a}d}{\sqrt[3]{b}}\right)}{3b} \\ & + \frac{\text{CosIntegral}\left(\frac{(-1)^{2/3}\sqrt[3]{a}d}{\sqrt[3]{b}}+dx\right)\sin\left(c-\frac{(-1)^{2/3}\sqrt[3]{a}d}{\sqrt[3]{b}}\right)}{3b} \\ & - \frac{\cos\left(c+\frac{\sqrt[3]{-1}\sqrt[3]{a}d}{\sqrt[3]{b}}\right)\text{Si}\left(\frac{\sqrt[3]{-1}\sqrt[3]{a}d}{\sqrt[3]{b}}-dx\right)}{3b} \\ & + \frac{\cos\left(c-\frac{\sqrt[3]{a}d}{\sqrt[3]{b}}\right)\text{Si}\left(\frac{\sqrt[3]{a}d}{\sqrt[3]{b}}+dx\right)}{3b} \\ & + \frac{\cos\left(c-\frac{(-1)^{2/3}\sqrt[3]{a}d}{\sqrt[3]{b}}\right)\text{Si}\left(\frac{(-1)^{2/3}\sqrt[3]{a}d}{\sqrt[3]{b}}+dx\right)}{3b}\end{aligned}$$

output
```
1/3*cos(c+(-1)^(1/3)*a^(1/3)*d/b^(1/3))*Si(-(-1)^(1/3)*a^(1/3)*d/b^(1/3)+d
*x)/b+1/3*cos(c-a^(1/3)*d/b^(1/3))*Si(a^(1/3)*d/b^(1/3)+d*x)/b+1/3*cos(c-(
-1)^(2/3)*a^(1/3)*d/b^(1/3))*Si((-1)^(2/3)*a^(1/3)*d/b^(1/3)+d*x)/b+1/3*Ci
(a^(1/3)*d/b^(1/3)+d*x)*sin(c-a^(1/3)*d/b^(1/3))/b+1/3*Ci((-1)^(1/3)*a^(1/
3)*d/b^(1/3)-d*x)*sin(c+(-1)^(1/3)*a^(1/3)*d/b^(1/3))/b+1/3*Ci((-1)^(2/3)*
a^(1/3)*d/b^(1/3)+d*x)*sin(c-(-1)^(2/3)*a^(1/3)*d/b^(1/3))/b
```

### 3.96.2 Mathematica [C] (verified)

Result contains higher order function than in optimal. Order 9 vs. order 4 in optimal.

Time = 5.04 (sec) , antiderivative size = 186, normalized size of antiderivative = 0.66

$$\int \frac{x^2\sin(c+dx)}{a+bx^3}\,dx$$
$$= \frac{i(\text{RootSum}[a+b\#1^3\&,\cos(c+d\#1)\,\text{CosIntegral}(d(x-\#1))-i\,\text{CosIntegral}(d(x-\#1))\sin(c+d\#1)}{}$$

input
```
Integrate[(x^2*Sin[c + d*x])/(a + b*x^3),x]
```

output
```
((I/6)*(RootSum[a + b*#1^3 & , Cos[c + d*#1]*CosIntegral[d*(x - #1)] - I*C
osIntegral[d*(x - #1)]*Sin[c + d*#1] - I*Cos[c + d*#1]*SinIntegral[d*(x -
#1)] - Sin[c + d*#1]*SinIntegral[d*(x - #1)] & ] - RootSum[a + b*#1^3 & ,
Cos[c + d*#1]*CosIntegral[d*(x - #1)] + I*CosIntegral[d*(x - #1)]*Sin[c +
d*#1] + I*Cos[c + d*#1]*SinIntegral[d*(x - #1)] - Sin[c + d*#1]*SinIntegra
l[d*(x - #1)] & ]))/b
```

### 3.96.3 Rubi [A] (verified)

Time = 0.67 (sec) , antiderivative size = 281, normalized size of antiderivative = 1.00, number of steps used = 2, number of rules used = 2, $\frac{\text{number of rules}}{\text{integrand size}} = 0.105$, Rules used = {3826, 2009}

Below are the steps used by Rubi to obtain the solution. The rule number used for the transformation is given above next to the arrow. The rules definitions used are listed below.

$$\int \frac{x^2\sin(c+dx)}{a+bx^3}\,dx$$
$$\Big\downarrow \text{ 3826}$$

$$\int \left( \frac{\sin(c+dx)}{3b^{2/3}\left(\sqrt[3]{a}+\sqrt[3]{b}x\right)} + \frac{\sin(c+dx)}{3b^{2/3}\left(\sqrt[3]{b}x-\sqrt[3]{-1}\sqrt[3]{a}\right)} + \frac{\sin(c+dx)}{3b^{2/3}\left((-1)^{2/3}\sqrt[3]{a}+\sqrt[3]{b}x\right)} \right) dx$$

$$\Big\downarrow \; 2009$$

$$\frac{\sin\left(c-\frac{\sqrt[3]{a}d}{\sqrt[3]{b}}\right)\text{CosIntegral}\left(xd+\frac{\sqrt[3]{a}d}{\sqrt[3]{b}}\right)}{3b} + \frac{\sin\left(\frac{\sqrt[3]{-1}\sqrt[3]{a}d}{\sqrt[3]{b}}+c\right)\text{CosIntegral}\left(\frac{\sqrt[3]{-1}\sqrt[3]{a}d}{\sqrt[3]{b}}-dx\right)}{3b} + \frac{\sin\left(c-\frac{(-1)^{2/3}\sqrt[3]{a}d}{\sqrt[3]{b}}\right)\text{CosIntegral}\left(xd+\frac{(-1)^{2/3}\sqrt[3]{a}d}{\sqrt[3]{b}}\right)}{3b} - \frac{\cos\left(\frac{\sqrt[3]{-1}\sqrt[3]{a}d}{\sqrt[3]{b}}+c\right)\text{Si}\left(\frac{\sqrt[3]{-1}\sqrt[3]{a}d}{\sqrt[3]{b}}-dx\right)}{3b} + \frac{\cos\left(c-\frac{\sqrt[3]{a}d}{\sqrt[3]{b}}\right)\text{Si}\left(xd+\frac{\sqrt[3]{a}d}{\sqrt[3]{b}}\right)}{3b} + \frac{\cos\left(c-\frac{(-1)^{2/3}\sqrt[3]{a}d}{\sqrt[3]{b}}\right)\text{Si}\left(xd+\frac{(-1)^{2/3}\sqrt[3]{a}d}{\sqrt[3]{b}}\right)}{3b}$$

input
```
Int[(x^2*Sin[c + d*x])/(a + b*x^3),x]
```

output
```
(CosIntegral[(a^(1/3)*d)/b^(1/3) + d*x]*Sin[c - (a^(1/3)*d)/b^(1/3)])/(3*b
) + (CosIntegral[((-1)^(1/3)*a^(1/3)*d)/b^(1/3) - d*x]*Sin[c + ((-1)^(1/3)
*a^(1/3)*d)/b^(1/3)])/(3*b) + (CosIntegral[((-1)^(2/3)*a^(1/3)*d)/b^(1/3)
+ d*x]*Sin[c - ((-1)^(2/3)*a^(1/3)*d)/b^(1/3)])/(3*b) - (Cos[c + ((-1)^(1/
3)*a^(1/3)*d)/b^(1/3)]*SinIntegral[((-1)^(1/3)*a^(1/3)*d)/b^(1/3) - d*x])/
(3*b) + (Cos[c - (a^(1/3)*d)/b^(1/3)]*SinIntegral[(a^(1/3)*d)/b^(1/3) + d*
x])/(3*b) + (Cos[c - ((-1)^(2/3)*a^(1/3)*d)/b^(1/3)]*SinIntegral[((-1)^(2/
3)*a^(1/3)*d)/b^(1/3) + d*x])/(3*b)
```

### 3.96.3.1 Defintions of rubi rules used

rule 2009
```
Int[u_, x_Symbol] :> Simp[IntSum[u, x], x] /; SumQ[u]
```

rule 3826
```
Int[(x_)^(m_.)*((a_) + (b_.)*(x_)^(n_))^(p_)*Sin[(c_.) + (d_.)*(x_)], x_Sym
bol] :> Int[ExpandIntegrand[Sin[c + d*x], x^m*(a + b*x^n)^p, x], x] /; Free
Q[{a, b, c, d, m}, x] && ILtQ[p, 0] && IGtQ[n, 0] && (EqQ[n, 2] || EqQ[p, -
1]) && IntegerQ[m]
```

### 3.96.4 Maple [C] (verified)

Result contains higher order function than in optimal. Order 9 vs. order 4.

Time = 0.29 (sec) , antiderivative size = 266, normalized size of antiderivative = 0.95

| method | result |
|---|---|
| derivativedivides | $\frac{d^3c^2\left(\sum_{\_R1=\mathrm{RootOf}\left(b\_Z^3-3\_Z^2bc+3c^2b\_Z+a\,d^3-c^3b\right)}\frac{-\mathrm{Si}\left(-dx+\_R1-c\right)\cos\left(\_R1\right)+\mathrm{Ci}\left(dx-\_R1+c\right)\sin\left(\_R1\right)}{\_R1^2-2\_R1c+c^2}\right.}{3b}$ |
| default | $\frac{d^3c^2\left(\sum_{\_R1=\mathrm{RootOf}\left(b\_Z^3-3\_Z^2bc+3c^2b\_Z+a\,d^3-c^3b\right)}\frac{-\mathrm{Si}\left(-dx+\_R1-c\right)\cos\left(\_R1\right)+\mathrm{Ci}\left(dx-\_R1+c\right)\sin\left(\_R1\right)}{\_R1^2-2\_R1c+c^2}\right.}{3b}$ |
| risch | $-\frac{ic^2\left(\sum_{\_R1=\mathrm{RootOf}\left(-3i\_Z^2bc-id^3a+ib\,c^3+b\_Z^3-3c^2b\_Z\right)}\frac{e^{\_R1}\,\mathrm{Ei}_1\left(-idx-ic+\_R1\right)}{-2ic\_R1+\_R1^2-c^2}\right)}{6b}+\frac{ic^2\left(\sum_{\_R1=\mathrm{RootOf}\left(-3i\_\right.}\right.}{}$ |

input
```
int(x^2*sin(d*x+c)/(b*x^3+a),x,method=_RETURNVERBOSE)
```

output
```
1/d^3*(1/3*d^3*c^2/b*sum(1/(_R1^2-2*_R1*c+c^2)*(-Si(-d*x+_R1-c)*cos(_R1)+C
i(d*x-_R1+c)*sin(_R1)),_R1=RootOf(_Z^3*b-3*_Z^2*b*c+3*_Z*b*c^2+a*d^3-b*c^3
))-2/3*d^3*c/b*sum(_R1/(_R1^2-2*_R1*c+c^2)*(-Si(-d*x+_R1-c)*cos(_R1)+Ci(d*
x-_R1+c)*sin(_R1)),_R1=RootOf(_Z^3*b-3*_Z^2*b*c+3*_Z*b*c^2+a*d^3-b*c^3))+1
/3*d^3/b*sum(_R1^2/(_R1^2-2*_R1*c+c^2)*(-Si(-d*x+_R1-c)*cos(_R1)+Ci(d*x-_R
1+c)*sin(_R1)),_R1=RootOf(_Z^3*b-3*_Z^2*b*c+3*_Z*b*c^2+a*d^3-b*c^3)))
```

### 3.96.5 Fricas [C] (verification not implemented)

Result contains complex when optimal does not.

Time = 0.28 (sec) , antiderivative size = 292, normalized size of antiderivative = 1.04

$$\int \frac{x^2\sin(c+dx)}{a+bx^3}\,dx$$
$$= \frac{i\,\mathrm{Ei}\left(-i\,dx+\frac{1}{2}\left(\frac{i\,ad^3}{b}\right)^{\frac{1}{3}}\left(-i\sqrt{3}-1\right)\right)e^{\left(\frac{1}{2}\left(\frac{i\,ad^3}{b}\right)^{\frac{1}{3}}\left(i\sqrt{3}+1\right)-i\,c\right)}-i\,\mathrm{Ei}\left(i\,dx+\frac{1}{2}\left(-\frac{i\,ad^3}{b}\right)^{\frac{1}{3}}\left(-i\sqrt{3}-1\right)\right)e}{}$$

input
```
integrate(x^2*sin(d*x+c)/(b*x^3+a),x, algorithm="fricas")
```

output
```
1/6*(I*Ei(-I*d*x + 1/2*(I*a*d^3/b)^(1/3)*(-I*sqrt(3) - 1))*e^(1/2*(I*a*d^3
/b)^(1/3)*(I*sqrt(3) + 1) - I*c) - I*Ei(I*d*x + 1/2*(-I*a*d^3/b)^(1/3)*(-I
*sqrt(3) - 1))*e^(1/2*(-I*a*d^3/b)^(1/3)*(I*sqrt(3) + 1) + I*c) + I*Ei(-I*
d*x + 1/2*(I*a*d^3/b)^(1/3)*(I*sqrt(3) - 1))*e^(1/2*(I*a*d^3/b)^(1/3)*(-I*
sqrt(3) + 1) - I*c) - I*Ei(I*d*x + 1/2*(-I*a*d^3/b)^(1/3)*(I*sqrt(3) - 1))
*e^(1/2*(-I*a*d^3/b)^(1/3)*(-I*sqrt(3) + 1) + I*c) - I*Ei(I*d*x + (-I*a*d^
3/b)^(1/3))*e^(I*c - (-I*a*d^3/b)^(1/3)) + I*Ei(-I*d*x + (I*a*d^3/b)^(1/3)
)*e^(-I*c - (I*a*d^3/b)^(1/3)))/b
```

### 3.96.6 Sympy [F]

$$\int \frac{x^2\sin(c+dx)}{a+bx^3}\,dx = \int \frac{x^2\sin{(c+dx)}}{a+bx^3}\,dx$$

input
```
integrate(x**2*sin(d*x+c)/(b*x**3+a),x)
```

output
```
Integral(x**2*sin(c + d*x)/(a + b*x**3), x)
```

### 3.96.7 Maxima [F]

$$\int \frac{x^2\sin(c+dx)}{a+bx^3}\,dx = \int \frac{x^2\sin{(dx+c)}}{bx^3+a}\,dx$$

input
```
integrate(x^2*sin(d*x+c)/(b*x^3+a),x, algorithm="maxima")
```

output
```
-1/2*((cos(c)^2 + sin(c)^2)*d*x^2*cos(d*x + c) + (cos(c)^2 + sin(c)^2)*x*s
in(d*x + c) + ((d*x^2*cos(c) - x*sin(c))*cos(d*x + c)^2 + (d*x^2*cos(c) -
x*sin(c))*sin(d*x + c)^2)*cos(d*x + 2*c) + 2*(((b*cos(c)^2 + b*sin(c)^2)*d
^2*x^3 + (a*cos(c)^2 + a*sin(c)^2)*d^2)*cos(d*x + c)^2 + ((b*cos(c)^2 + b*
sin(c)^2)*d^2*x^3 + (a*cos(c)^2 + a*sin(c)^2)*d^2)*sin(d*x + c)^2)*integra
te(-1/2*(3*a*d*x*cos(d*x + c) - (2*b*x^3 - a)*sin(d*x + c))/(b^2*d^2*x^6 +
 2*a*b*d^2*x^3 + a^2*d^2), x) + 2*(((b*cos(c)^2 + b*sin(c)^2)*d^2*x^3 + (a
*cos(c)^2 + a*sin(c)^2)*d^2)*cos(d*x + c)^2 + ((b*cos(c)^2 + b*sin(c)^2)*d
^2*x^3 + (a*cos(c)^2 + a*sin(c)^2)*d^2)*sin(d*x + c)^2)*integrate(-1/2*(3*
a*d*x*cos(d*x + c) - (2*b*x^3 - a)*sin(d*x + c))/((b^2*d^2*x^6 + 2*a*b*d^2
*x^3 + a^2*d^2)*cos(d*x + c)^2 + (b^2*d^2*x^6 + 2*a*b*d^2*x^3 + a^2*d^2)*s
in(d*x + c)^2), x) + ((d*x^2*sin(c) + x*cos(c))*cos(d*x + c)^2 + (d*x^2*si
n(c) + x*cos(c))*sin(d*x + c)^2)*sin(d*x + 2*c))/(((b*cos(c)^2 + b*sin(c)^
2)*d^2*x^3 + (a*cos(c)^2 + a*sin(c)^2)*d^2)*cos(d*x + c)^2 + ((b*cos(c)^2
+ b*sin(c)^2)*d^2*x^3 + (a*cos(c)^2 + a*sin(c)^2)*d^2)*sin(d*x + c)^2)
```

### 3.96.8 Giac [F]

$$\int \frac{x^2 \sin(c+dx)}{a+bx^3} \, dx = \int \frac{x^2 \sin{(dx+c)}}{bx^3+a} \, dx$$

input
```
integrate(x^2*sin(d*x+c)/(b*x^3+a),x, algorithm="giac")
```

output
```
integrate(x^2*sin(d*x + c)/(b*x^3 + a), x)
```

### 3.96.9 Mupad [F(-1)]

Timed out.

$$\int \frac{x^2 \sin(c+dx)}{a+bx^3} \, dx = \int \frac{x^2 \sin{(c+d\,x)}}{b\,x^3+a} \, dx$$

input
```
int((x^2*sin(c + d*x))/(a + b*x^3),x)
```

output
```
int((x^2*sin(c + d*x))/(a + b*x^3), x)
```

# 3.97 $\int \frac{x\sin(c+dx)}{a+bx^3}\,dx$



## 3.97.1 Optimal result

Integrand size = 17, antiderivative size = 343

$$\begin{aligned}\int \frac{x\sin(c+dx)}{a+bx^3}\,dx = &-\frac{\text{CosIntegral}\left(\frac{\sqrt[3]{a}d}{\sqrt[3]{b}}+dx\right)\sin\left(c-\frac{\sqrt[3]{a}d}{\sqrt[3]{b}}\right)}{3\sqrt[3]{a}b^{2/3}}\\
&-\frac{(-1)^{2/3}\,\text{CosIntegral}\left(\frac{\sqrt[3]{-1}\sqrt[3]{a}d}{\sqrt[3]{b}}-dx\right)\sin\left(c+\frac{\sqrt[3]{-1}\sqrt[3]{a}d}{\sqrt[3]{b}}\right)}{3\sqrt[3]{a}b^{2/3}}\\
&+\frac{\sqrt[3]{-1}\,\text{CosIntegral}\left(\frac{(-1)^{2/3}\sqrt[3]{a}d}{\sqrt[3]{b}}+dx\right)\sin\left(c-\frac{(-1)^{2/3}\sqrt[3]{a}d}{\sqrt[3]{b}}\right)}{3\sqrt[3]{a}b^{2/3}}\\
&+\frac{(-1)^{2/3}\cos\left(c+\frac{\sqrt[3]{-1}\sqrt[3]{a}d}{\sqrt[3]{b}}\right)\text{Si}\left(\frac{\sqrt[3]{-1}\sqrt[3]{a}d}{\sqrt[3]{b}}-dx\right)}{3\sqrt[3]{a}b^{2/3}}\\
&-\frac{\cos\left(c-\frac{\sqrt[3]{a}d}{\sqrt[3]{b}}\right)\text{Si}\left(\frac{\sqrt[3]{a}d}{\sqrt[3]{b}}+dx\right)}{3\sqrt[3]{a}b^{2/3}}\\
&+\frac{\sqrt[3]{-1}\cos\left(c-\frac{(-1)^{2/3}\sqrt[3]{a}d}{\sqrt[3]{b}}\right)\text{Si}\left(\frac{(-1)^{2/3}\sqrt[3]{a}d}{\sqrt[3]{b}}+dx\right)}{3\sqrt[3]{a}b^{2/3}}\end{aligned}$$

output
```
-1/3*(-1)^(2/3)*cos(c+(-1)^(1/3)*a^(1/3)*d/b^(1/3))*Si(-(-1)^(1/3)*a^(1/3)
*d/b^(1/3)+d*x)/a^(1/3)/b^(2/3)-1/3*cos(c-a^(1/3)*d/b^(1/3))*Si(a^(1/3)*d/
b^(1/3)+d*x)/a^(1/3)/b^(2/3)+1/3*(-1)^(1/3)*cos(c-(-1)^(2/3)*a^(1/3)*d/b^(
1/3))*Si((-1)^(2/3)*a^(1/3)*d/b^(1/3)+d*x)/a^(1/3)/b^(2/3)-1/3*Ci(a^(1/3)*
d/b^(1/3)+d*x)*sin(c-a^(1/3)*d/b^(1/3))/a^(1/3)/b^(2/3)-1/3*(-1)^(2/3)*Ci(
(-1)^(1/3)*a^(1/3)*d/b^(1/3)-d*x)*sin(c+(-1)^(1/3)*a^(1/3)*d/b^(1/3))/a^(1
/3)/b^(2/3)+1/3*(-1)^(1/3)*Ci((-1)^(2/3)*a^(1/3)*d/b^(1/3)+d*x)*sin(c-(-1)
^(2/3)*a^(1/3)*d/b^(1/3))/a^(1/3)/b^(2/3)
```

### 3.97.2 Mathematica [C] (verified)

Result contains higher order function than in optimal. Order 9 vs. order 4 in optimal.

Time = 5.05 (sec) , antiderivative size = 196, normalized size of antiderivative = 0.57

$$\int \frac{x\sin(c+dx)}{a+bx^3}\,dx$$
$$= \frac{i\left(\text{RootSum}\left[a+b\#1^3\&,\frac{\cos(c+d\#1)\,\text{CosIntegral}(d(x-\#1))-i\,\text{CosIntegral}(d(x-\#1))\sin(c+d\#1)-i\cos(c+d\#1)\text{Si}(d(x-\#1))}{\#1}\right.\right.}{}$$

input
```
Integrate[(x*Sin[c + d*x])/(a + b*x^3),x]
```

output
```
((I/6)*(RootSum[a + b*#1^3 & , (Cos[c + d*#1]*CosIntegral[d*(x - #1)] - I*
CosIntegral[d*(x - #1)]*Sin[c + d*#1] - I*Cos[c + d*#1]*SinIntegral[d*(x -
 #1)] - Sin[c + d*#1]*SinIntegral[d*(x - #1)])/#1 & ] - RootSum[a + b*#1^3
 & , (Cos[c + d*#1]*CosIntegral[d*(x - #1)] + I*CosIntegral[d*(x - #1)]*Si
n[c + d*#1] + I*Cos[c + d*#1]*SinIntegral[d*(x - #1)] - Sin[c + d*#1]*SinI
ntegral[d*(x - #1)])/#1 & ]))/b
```

### 3.97.3 Rubi [A] (verified)

Time = 0.65 (sec) , antiderivative size = 343, normalized size of antiderivative = 1.00, number of steps used = 2, number of rules used = 2, $\frac{\text{number of rules}}{\text{integrand size}}$ = 0.118, Rules used = {3826, 2009}

Below are the steps used by Rubi to obtain the solution. The rule number used for the transformation is given above next to the arrow. The rules definitions used are listed below.

$$\int \frac{x\sin(c+dx)}{a+bx^3}\,dx$$

$$\Big\downarrow \ \textbf{3826}$$

$$\int \left(-\frac{\sin(c+dx)}{3\sqrt[3]{a}\sqrt[3]{b}\left(\sqrt[3]{a}+\sqrt[3]{b}x\right)}-\frac{(-1)^{2/3}\sin(c+dx)}{3\sqrt[3]{a}\sqrt[3]{b}\left(\sqrt[3]{a}-\sqrt[3]{-1}\sqrt[3]{b}x\right)}+\frac{\sqrt[3]{-1}\sin(c+dx)}{3\sqrt[3]{a}\sqrt[3]{b}\left(\sqrt[3]{a}+(-1)^{2/3}\sqrt[3]{b}x\right)}\right)dx$$

$$\Big\downarrow \ \textbf{2009}$$

$$-\frac{\sin\left(c-\frac{\sqrt[3]{a}d}{\sqrt[3]{b}}\right)\text{CosIntegral}\left(xd+\frac{\sqrt[3]{a}d}{\sqrt[3]{b}}\right)}{3\sqrt[3]{a}b^{2/3}}-\frac{(-1)^{2/3}\sin\left(\frac{\sqrt[3]{-1}\sqrt[3]{a}d}{\sqrt[3]{b}}+c\right)\text{CosIntegral}\left(\frac{\sqrt[3]{-1}\sqrt[3]{a}d}{\sqrt[3]{b}}-dx\right)}{3\sqrt[3]{a}b^{2/3}}+\frac{\sqrt[3]{-1}\sin\left(c-\frac{(-1)^{2/3}\sqrt[3]{a}d}{\sqrt[3]{b}}\right)\text{CosIntegral}\left(xd+\frac{(-1)^{2/3}\sqrt[3]{a}d}{\sqrt[3]{b}}\right)}{3\sqrt[3]{a}b^{2/3}}+\frac{(-1)^{2/3}\cos\left(\frac{\sqrt[3]{-1}\sqrt[3]{a}d}{\sqrt[3]{b}}+c\right)\text{Si}\left(\frac{\sqrt[3]{-1}\sqrt[3]{a}d}{\sqrt[3]{b}}-dx\right)}{3\sqrt[3]{a}b^{2/3}}-\frac{\cos\left(c-\frac{\sqrt[3]{a}d}{\sqrt[3]{b}}\right)\text{Si}\left(xd+\frac{\sqrt[3]{a}d}{\sqrt[3]{b}}\right)}{3\sqrt[3]{a}b^{2/3}}+\frac{\sqrt[3]{-1}\cos\left(c-\frac{(-1)^{2/3}\sqrt[3]{a}d}{\sqrt[3]{b}}\right)\text{Si}\left(xd+\frac{(-1)^{2/3}\sqrt[3]{a}d}{\sqrt[3]{b}}\right)}{3\sqrt[3]{a}b^{2/3}}$$

input
```
Int[(x*Sin[c + d*x])/(a + b*x^3),x]
```

output
```
-1/3*(CosIntegral[(a^(1/3)*d)/b^(1/3) + d*x]*Sin[c - (a^(1/3)*d)/b^(1/3)])
/(a^(1/3)*b^(2/3)) - ((-1)^(2/3)*CosIntegral[((-1)^(1/3)*a^(1/3)*d)/b^(1/3
) - d*x]*Sin[c + ((-1)^(1/3)*a^(1/3)*d)/b^(1/3)])/(3*a^(1/3)*b^(2/3)) + ((
-1)^(1/3)*CosIntegral[((-1)^(2/3)*a^(1/3)*d)/b^(1/3) + d*x]*Sin[c - ((-1)^
(2/3)*a^(1/3)*d)/b^(1/3)])/(3*a^(1/3)*b^(2/3)) + ((-1)^(2/3)*Cos[c + ((-1)
^(1/3)*a^(1/3)*d)/b^(1/3)]*SinIntegral[((-1)^(1/3)*a^(1/3)*d)/b^(1/3) - d*
x])/(3*a^(1/3)*b^(2/3)) - (Cos[c - (a^(1/3)*d)/b^(1/3)]*SinIntegral[(a^(1/
3)*d)/b^(1/3) + d*x])/(3*a^(1/3)*b^(2/3)) + ((-1)^(1/3)*Cos[c - ((-1)^(2/3
)*a^(1/3)*d)/b^(1/3)]*SinIntegral[((-1)^(2/3)*a^(1/3)*d)/b^(1/3) + d*x])/(
3*a^(1/3)*b^(2/3))
```

## 3.97. $\int \frac{x\sin(c+dx)}{a+bx^3}\,dx$

#### 3.97.3.1 Defintions of rubi rules used

rule 2009
```
Int[u_, x_Symbol] :> Simp[IntSum[u, x], x] /; SumQ[u]
```

rule 3826
```
Int[(x_)^(m_.)*((a_) + (b_.)*(x_)^(n_))^(p_)*Sin[(c_.) + (d_.)*(x_)], x_Sym
bol] :> Int[ExpandIntegrand[Sin[c + d*x], x^m*(a + b*x^n)^p, x], x] /; Free
Q[{a, b, c, d, m}, x] && ILtQ[p, 0] && IGtQ[n, 0] && (EqQ[n, 2] || EqQ[p, -
1]) && IntegerQ[m]
```

### 3.97.4 Maple [C] (verified)

Result contains higher order function than in optimal. Order 9 vs. order 4.

Time = 0.28 (sec) , antiderivative size = 176, normalized size of antiderivative = 0.51

| method | result |
|---|---|
| derivativedivides | $\frac{d^3\left(\sum_{\_R1=\text{RootOf}\left(b\_Z^3-3\_Z^2bc+3c^2b\_Z+a\,d^3-c^3b\right)}\frac{\_R1\left(-\text{Si}\left(-dx+\_R1-c\right)\cos\left(\_R1\right)+\text{Ci}\left(dx-\_R1+c\right)\sin\left(\_\right.\right.}{\_R1^2-2\_R1c+c^2}}{3b}$ |
| default | $\frac{d^3\left(\sum_{\_R1=\text{RootOf}\left(b\_Z^3-3\_Z^2bc+3c^2b\_Z+a\,d^3-c^3b\right)}\frac{\_R1\left(-\text{Si}\left(-dx+\_R1-c\right)\cos\left(\_R1\right)+\text{Ci}\left(dx-\_R1+c\right)\sin\left(\_\right.\right.}{\_R1^2-2\_R1c+c^2}}{3b}$ |
| risch | $\frac{d\left(\sum_{\_R1=\text{RootOf}\left(-3i\_Z^2bc-id^3a+ibc^3+b\_Z^3-3c^2b\_Z\right)}\frac{\_R1\,e^{-\_R1}\,\text{Ei}_1\left(idx+ic-\_R1\right)}{-2ic\_R1+\_R1^2-c^2}\right)}{6b}-\frac{idc\left(\sum_{\_R1=\text{RootOf}\left(-\right.}\right.}{}$ |

input
```
int(x*sin(d*x+c)/(b*x^3+a),x,method=_RETURNVERBOSE)
```

output
```
1/d^2*(1/3*d^3/b*sum(_R1/(_R1^2-2*_R1*c+c^2)*(-Si(-d*x+_R1-c)*cos(_R1)+Ci(
d*x-_R1+c)*sin(_R1)),_R1=RootOf(_Z^3*b-3*_Z^2*b*c+3*_Z*b*c^2+a*d^3-b*c^3))
-1/3*d^3*c/b*sum(1/(_R1^2-2*_R1*c+c^2)*(-Si(-d*x+_R1-c)*cos(_R1)+Ci(d*x-_R
1+c)*sin(_R1)),_R1=RootOf(_Z^3*b-3*_Z^2*b*c+3*_Z*b*c^2+a*d^3-b*c^3)))
```

### 3.97.5 Fricas [C] (verification not implemented)

Result contains complex when optimal does not.

Time = 0.30 (sec) , antiderivative size = 379, normalized size of antiderivative = 1.10

$$\int \frac{x\sin(c+dx)}{a+bx^3}\,dx =$$

$$-\frac{\left(\frac{i\,ad^3}{b}\right)^{\frac{2}{3}}(\sqrt{3}+i)\mathrm{Ei}\left(-i\,dx+\frac{1}{2}\left(\frac{i\,ad^3}{b}\right)^{\frac{1}{3}}\left(-i\sqrt{3}-1\right)\right)e^{\left(\frac{1}{2}\left(\frac{i\,ad^3}{b}\right)^{\frac{1}{3}}\left(i\sqrt{3}+1\right)-i\,c\right)}-\left(-\frac{i\,ad^3}{b}\right)^{\frac{2}{3}}(\sqrt{3}+i)\mathrm{Ei}}{}$$

input
```
integrate(x*sin(d*x+c)/(b*x^3+a),x, algorithm="fricas")
```

output
```
-1/12*((I*a*d^3/b)^(2/3)*(sqrt(3) + I)*Ei(-I*d*x + 1/2*(I*a*d^3/b)^(1/3)*(
-I*sqrt(3) - 1))*e^(1/2*(I*a*d^3/b)^(1/3)*(I*sqrt(3) + 1) - I*c) - (-I*a*d
^3/b)^(2/3)*(sqrt(3) + I)*Ei(I*d*x + 1/2*(-I*a*d^3/b)^(1/3)*(-I*sqrt(3) -
1))*e^(1/2*(-I*a*d^3/b)^(1/3)*(I*sqrt(3) + 1) + I*c) - (I*a*d^3/b)^(2/3)*(
sqrt(3) - I)*Ei(-I*d*x + 1/2*(I*a*d^3/b)^(1/3)*(I*sqrt(3) - 1))*e^(1/2*(I*
a*d^3/b)^(1/3)*(-I*sqrt(3) + 1) - I*c) + (-I*a*d^3/b)^(2/3)*(sqrt(3) - I)*
Ei(I*d*x + 1/2*(-I*a*d^3/b)^(1/3)*(I*sqrt(3) - 1))*e^(1/2*(-I*a*d^3/b)^(1/
3)*(-I*sqrt(3) + 1) + I*c) + 2*I*(-I*a*d^3/b)^(2/3)*Ei(I*d*x + (-I*a*d^3/b
)^(1/3))*e^(I*c - (-I*a*d^3/b)^(1/3)) - 2*I*(I*a*d^3/b)^(2/3)*Ei(-I*d*x +
(I*a*d^3/b)^(1/3))*e^(-I*c - (I*a*d^3/b)^(1/3)))/(a*d^2)
```

### 3.97.6 Sympy [F]

$$\int \frac{x\sin(c+dx)}{a+bx^3}\,dx = \int \frac{x\sin(c+dx)}{a+bx^3}\,dx$$

input
```
integrate(x*sin(d*x+c)/(b*x**3+a),x)
```

output
```
Integral(x*sin(c + d*x)/(a + b*x**3), x)
```

### 3.97.7 Maxima [F]

$$\int \frac{x\sin(c+dx)}{a+bx^3}\,dx = \int \frac{x\sin(dx+c)}{bx^3+a}\,dx$$

input
```
integrate(x*sin(d*x+c)/(b*x^3+a),x, algorithm="maxima")
```

output
```
-1/2*((cos(c)^2 + sin(c)^2)*x*cos(d*x + c) + (x*cos(d*x + c)^2*cos(c) + x*
cos(c)*sin(d*x + c)^2)*cos(d*x + 2*c) + 2*(((b*cos(c)^2 + b*sin(c)^2)*d*x^
3 + (a*cos(c)^2 + a*sin(c)^2)*d)*cos(d*x + c)^2 + ((b*cos(c)^2 + b*sin(c)^
2)*d*x^3 + (a*cos(c)^2 + a*sin(c)^2)*d)*sin(d*x + c)^2)*integrate(1/2*(2*b
*x^3 - a)*cos(d*x + c)/(b^2*d*x^6 + 2*a*b*d*x^3 + a^2*d), x) + 2*(((b*cos(
c)^2 + b*sin(c)^2)*d*x^3 + (a*cos(c)^2 + a*sin(c)^2)*d)*cos(d*x + c)^2 + (
(b*cos(c)^2 + b*sin(c)^2)*d*x^3 + (a*cos(c)^2 + a*sin(c)^2)*d)*sin(d*x + c
)^2)*integrate(1/2*(2*b*x^3 - a)*cos(d*x + c)/((b^2*d*x^6 + 2*a*b*d*x^3 +
a^2*d)*cos(d*x + c)^2 + (b^2*d*x^6 + 2*a*b*d*x^3 + a^2*d)*sin(d*x + c)^2),
 x) + (x*cos(d*x + c)^2*sin(c) + x*sin(d*x + c)^2*sin(c))*sin(d*x + 2*c))/
(((b*cos(c)^2 + b*sin(c)^2)*d*x^3 + (a*cos(c)^2 + a*sin(c)^2)*d)*cos(d*x +
 c)^2 + ((b*cos(c)^2 + b*sin(c)^2)*d*x^3 + (a*cos(c)^2 + a*sin(c)^2)*d)*si
n(d*x + c)^2)
```

### 3.97.8 Giac [F]

$$\int \frac{x\sin(c+dx)}{a+bx^3}\,dx = \int \frac{x\sin(dx+c)}{bx^3+a}\,dx$$

input
```
integrate(x*sin(d*x+c)/(b*x^3+a),x, algorithm="giac")
```

output
```
integrate(x*sin(d*x + c)/(b*x^3 + a), x)
```

### 3.97.9 Mupad [F(-1)]

Timed out.

$$\int \frac{x\sin(c+dx)}{a+bx^3}\,dx=\int \frac{x\,\sin\left(c+d\,x\right)}{b\,x^3+a}\,dx$$

input
```
int((x*sin(c + d*x))/(a + b*x^3),x)
```

output
```
int((x*sin(c + d*x))/(a + b*x^3), x)
```

# 3.98 $\int \frac{\sin(c+dx)}{a+bx^3}\,dx$



## 3.98.1 Optimal result

Integrand size = 16, antiderivative size = 343

$$\begin{aligned}\int \frac{\sin(c+dx)}{a+bx^3}\,dx &= \frac{\text{CosIntegral}\left(\frac{\sqrt[3]{a}d}{\sqrt[3]{b}}+dx\right)\sin\left(c-\frac{\sqrt[3]{a}d}{\sqrt[3]{b}}\right)}{3a^{2/3}\sqrt[3]{b}} \\
&- \frac{\sqrt[3]{-1}\,\text{CosIntegral}\left(\frac{\sqrt[3]{-1}\sqrt[3]{a}d}{\sqrt[3]{b}}-dx\right)\sin\left(c+\frac{\sqrt[3]{-1}\sqrt[3]{a}d}{\sqrt[3]{b}}\right)}{3a^{2/3}\sqrt[3]{b}} \\
&+ \frac{(-1)^{2/3}\,\text{CosIntegral}\left(\frac{(-1)^{2/3}\sqrt[3]{a}d}{\sqrt[3]{b}}+dx\right)\sin\left(c-\frac{(-1)^{2/3}\sqrt[3]{a}d}{\sqrt[3]{b}}\right)}{3a^{2/3}\sqrt[3]{b}} \\
&+ \frac{\sqrt[3]{-1}\cos\left(c+\frac{\sqrt[3]{-1}\sqrt[3]{a}d}{\sqrt[3]{b}}\right)\text{Si}\left(\frac{\sqrt[3]{-1}\sqrt[3]{a}d}{\sqrt[3]{b}}-dx\right)}{3a^{2/3}\sqrt[3]{b}} \\
&+ \frac{\cos\left(c-\frac{\sqrt[3]{a}d}{\sqrt[3]{b}}\right)\text{Si}\left(\frac{\sqrt[3]{a}d}{\sqrt[3]{b}}+dx\right)}{3a^{2/3}\sqrt[3]{b}} \\
&+ \frac{(-1)^{2/3}\cos\left(c-\frac{(-1)^{2/3}\sqrt[3]{a}d}{\sqrt[3]{b}}\right)\text{Si}\left(\frac{(-1)^{2/3}\sqrt[3]{a}d}{\sqrt[3]{b}}+dx\right)}{3a^{2/3}\sqrt[3]{b}}\end{aligned}$$

output
```
-1/3*(-1)^(1/3)*cos(c+(-1)^(1/3)*a^(1/3)*d/b^(1/3))*Si(-(-1)^(1/3)*a^(1/3)
*d/b^(1/3)+d*x)/a^(2/3)/b^(1/3)+1/3*cos(c-a^(1/3)*d/b^(1/3))*Si(a^(1/3)*d/
b^(1/3)+d*x)/a^(2/3)/b^(1/3)+1/3*(-1)^(2/3)*cos(c-(-1)^(2/3)*a^(1/3)*d/b^(
1/3))*Si((-1)^(2/3)*a^(1/3)*d/b^(1/3)+d*x)/a^(2/3)/b^(1/3)+1/3*Ci(a^(1/3)*
d/b^(1/3)+d*x)*sin(c-a^(1/3)*d/b^(1/3))/a^(2/3)/b^(1/3)-1/3*(-1)^(1/3)*Ci(
(-1)^(1/3)*a^(1/3)*d/b^(1/3)-d*x)*sin(c+(-1)^(1/3)*a^(1/3)*d/b^(1/3))/a^(2
/3)/b^(1/3)+1/3*(-1)^(2/3)*Ci((-1)^(2/3)*a^(1/3)*d/b^(1/3)+d*x)*sin(c-(-1)
^(2/3)*a^(1/3)*d/b^(1/3))/a^(2/3)/b^(1/3)
```

## 3.98.2 Mathematica [C] (verified)

Result contains higher order function than in optimal. Order 9 vs. order 4 in optimal.

Time = 5.05 (sec) , antiderivative size = 196, normalized size of antiderivative = 0.57

$$\int \frac{\sin(c+dx)}{a+bx^3}\,dx$$
$$= \frac{i\left(\text{RootSum}\left[a+b\#1^3\&,\frac{\cos(c+d\#1)\,\text{CosIntegral}(d(x-\#1))-i\,\text{CosIntegral}(d(x-\#1))\sin(c+d\#1)-i\cos(c+d\#1)\text{Si}(d(x-\#1)}{\#1^2}\right.\right.}{}$$

input
```
Integrate[Sin[c + d*x]/(a + b*x^3),x]
```

output
```
((I/6)*(RootSum[a + b*#1^3 & , (Cos[c + d*#1]*CosIntegral[d*(x - #1)] - I*
CosIntegral[d*(x - #1)]*Sin[c + d*#1] - I*Cos[c + d*#1]*SinIntegral[d*(x -
 #1)] - Sin[c + d*#1]*SinIntegral[d*(x - #1)])/#1^2 & ] - RootSum[a + b*#1
^3 & , (Cos[c + d*#1]*CosIntegral[d*(x - #1)] + I*CosIntegral[d*(x - #1)]*
Sin[c + d*#1] + I*Cos[c + d*#1]*SinIntegral[d*(x - #1)] - Sin[c + d*#1]*Si
nIntegral[d*(x - #1)])/#1^2 & ]))/b
```

## 3.98.3 Rubi [A] (verified)

Time = 0.63 (sec) , antiderivative size = 343, normalized size of antiderivative = 1.00, number of steps used = 2, number of rules used = 2, $\frac{\text{number of rules}}{\text{integrand size}}$ = 0.125, Rules used = {3814, 2009}

Below are the steps used by Rubi to obtain the solution. The rule number used for the transformation is given above next to the arrow. The rules definitions used are listed below.

$$\int \frac{\sin(c+dx)}{a+bx^3}\,dx$$

$$\Big\downarrow \text{3814}$$

$$\int \left(-\frac{\sin(c+dx)}{3a^{2/3}\left(-\sqrt[3]{a}-\sqrt[3]{b}x\right)}-\frac{\sin(c+dx)}{3a^{2/3}\left(\sqrt[3]{-1}\sqrt[3]{b}x-\sqrt[3]{a}\right)}-\frac{\sin(c+dx)}{3a^{2/3}\left(-\sqrt[3]{a}-(-1)^{2/3}\sqrt[3]{b}x\right)}\right)dx$$

$$\Big\downarrow \text{2009}$$

$$\frac{\sin\left(c-\frac{\sqrt[3]{a}d}{\sqrt[3]{b}}\right)\text{CosIntegral}\left(xd+\frac{\sqrt[3]{a}d}{\sqrt[3]{b}}\right)}{3a^{2/3}\sqrt[3]{b}}-\frac{\sqrt[3]{-1}\sin\left(\frac{\sqrt[3]{-1}\sqrt[3]{a}d}{\sqrt[3]{b}}+c\right)\text{CosIntegral}\left(\frac{\sqrt[3]{-1}\sqrt[3]{a}d}{\sqrt[3]{b}}-dx\right)}{3a^{2/3}\sqrt[3]{b}}+\frac{(-1)^{2/3}\sin\left(c-\frac{(-1)^{2/3}\sqrt[3]{a}d}{\sqrt[3]{b}}\right)\text{CosIntegral}\left(xd+\frac{(-1)^{2/3}\sqrt[3]{a}d}{\sqrt[3]{b}}\right)}{3a^{2/3}\sqrt[3]{b}}+\frac{\sqrt[3]{-1}\cos\left(\frac{\sqrt[3]{-1}\sqrt[3]{a}d}{\sqrt[3]{b}}+c\right)\text{Si}\left(\frac{\sqrt[3]{-1}\sqrt[3]{a}d}{\sqrt[3]{b}}-dx\right)}{3a^{2/3}\sqrt[3]{b}}+\frac{\cos\left(c-\frac{\sqrt[3]{a}d}{\sqrt[3]{b}}\right)\text{Si}\left(xd+\frac{\sqrt[3]{a}d}{\sqrt[3]{b}}\right)}{3a^{2/3}\sqrt[3]{b}}+\frac{(-1)^{2/3}\cos\left(c-\frac{(-1)^{2/3}\sqrt[3]{a}d}{\sqrt[3]{b}}\right)\text{Si}\left(xd+\frac{(-1)^{2/3}\sqrt[3]{a}d}{\sqrt[3]{b}}\right)}{3a^{2/3}\sqrt[3]{b}}$$

input
```
Int[Sin[c + d*x]/(a + b*x^3),x]
```

output
```
(CosIntegral[(a^(1/3)*d)/b^(1/3) + d*x]*Sin[c - (a^(1/3)*d)/b^(1/3)])/(3*a
^(2/3)*b^(1/3)) - ((-1)^(1/3)*CosIntegral[((-1)^(1/3)*a^(1/3)*d)/b^(1/3) -
 d*x]*Sin[c + ((-1)^(1/3)*a^(1/3)*d)/b^(1/3)])/(3*a^(2/3)*b^(1/3)) + ((-1)
^(2/3)*CosIntegral[((-1)^(2/3)*a^(1/3)*d)/b^(1/3) + d*x]*Sin[c - ((-1)^(2/
3)*a^(1/3)*d)/b^(1/3)])/(3*a^(2/3)*b^(1/3)) + ((-1)^(1/3)*Cos[c + ((-1)^(1
/3)*a^(1/3)*d)/b^(1/3)]*SinIntegral[((-1)^(1/3)*a^(1/3)*d)/b^(1/3) - d*x])
/(3*a^(2/3)*b^(1/3)) + (Cos[c - (a^(1/3)*d)/b^(1/3)]*SinIntegral[(a^(1/3)*
d)/b^(1/3) + d*x])/(3*a^(2/3)*b^(1/3)) + ((-1)^(2/3)*Cos[c - ((-1)^(2/3)*a
^(1/3)*d)/b^(1/3)]*SinIntegral[((-1)^(2/3)*a^(1/3)*d)/b^(1/3) + d*x])/(3*a
^(2/3)*b^(1/3))
```

## 3.98. $\int \frac{\sin(c+dx)}{a+bx^3}\,dx$

#### 3.98.3.1 Defintions of rubi rules used

rule 2009
```
Int[u_, x_Symbol] :> Simp[IntSum[u, x], x] /; SumQ[u]
```

rule 3814
```
Int[((a_) + (b_.)*(x_)^(n_))^(p_)*Sin[(c_.) + (d_.)*(x_)], x_Symbol] :> Int
[ExpandIntegrand[Sin[c + d*x], (a + b*x^n)^p, x], x] /; FreeQ[{a, b, c, d},
 x] && ILtQ[p, 0] && IGtQ[n, 0] && (EqQ[n, 2] || EqQ[p, -1])
```

### 3.98.4 Maple [C] (verified)

Result contains higher order function than in optimal. Order 9 vs. order 4.

Time = 0.27 (sec) , antiderivative size = 85, normalized size of antiderivative = 0.25

| method | result |
|---|---|
| derivativedivides | $\frac{d^2\left(\sum_{\_R1=\mathrm{RootOf}\left(b\_Z^3-3\_Z^2bc+3c^2b\_Z+a\,d^3-c^3b\right)}\frac{-\mathrm{Si}\left(-dx+\_R1-c\right)\cos\left(\_R1\right)+\mathrm{Ci}\left(dx-\_R1+c\right)\sin\left(\_R1\right)}{\_R1^2-2\_R1c+c^2}\right)}{3b}$ |
| default | $\frac{d^2\left(\sum_{\_R1=\mathrm{RootOf}\left(b\_Z^3-3\_Z^2bc+3c^2b\_Z+a\,d^3-c^3b\right)}\frac{-\mathrm{Si}\left(-dx+\_R1-c\right)\cos\left(\_R1\right)+\mathrm{Ci}\left(dx-\_R1+c\right)\sin\left(\_R1\right)}{\_R1^2-2\_R1c+c^2}\right)}{3b}$ |
| risch | $-\frac{id^2\left(\sum_{\_R1=\mathrm{RootOf}\left(-3i\_Z^2bc-id^3a+ib\,c^3+b\_Z^3-3c^2b\_Z\right)}\frac{e^{\_R1}\,\mathrm{Ei}_1\left(-idx-ic+\_R1\right)}{-2ic\_R1+\_R1^2-c^2}\right)}{6b}+\frac{id^2\left(\sum_{\_R1=\mathrm{RootOf}\left(-3i\ldots\right)}\right)}{}$ |

input
```
int(sin(d*x+c)/(b*x^3+a),x,method=_RETURNVERBOSE)
```

output
```
1/3*d^2/b*sum(1/(_R1^2-2*_R1*c+c^2)*(-Si(-d*x+_R1-c)*cos(_R1)+Ci(d*x-_R1+c
)*sin(_R1)),_R1=RootOf(_Z^3*b-3*_Z^2*b*c+3*_Z*b*c^2+a*d^3-b*c^3))
```

### 3.98.5 Fricas [C] (verification not implemented)

Result contains complex when optimal does not.

Time = 0.30 (sec) , antiderivative size = 385, normalized size of antiderivative = 1.12

$$\int \frac{\sin(c+dx)}{a+bx^3}\,dx$$
$$= \frac{\left(\frac{i\,ad^3}{b}\right)^{\frac{1}{3}}(i\sqrt{3}+1)\text{Ei}\left(-i\,dx+\frac{1}{2}\left(\frac{i\,ad^3}{b}\right)^{\frac{1}{3}}(-i\sqrt{3}-1)\right)e^{\left(\frac{1}{2}\left(\frac{i\,ad^3}{b}\right)^{\frac{1}{3}}(i\sqrt{3}+1)-i\,c\right)}+\left(-\frac{i\,ad^3}{b}\right)^{\frac{1}{3}}(i\sqrt{3}+1)\text{E}}{}$$

input
```
integrate(sin(d*x+c)/(b*x^3+a),x, algorithm="fricas")
```

output
```
1/12*((I*a*d^3/b)^(1/3)*(I*sqrt(3) + 1)*Ei(-I*d*x + 1/2*(I*a*d^3/b)^(1/3)*
(-I*sqrt(3) - 1))*e^(1/2*(I*a*d^3/b)^(1/3)*(I*sqrt(3) + 1) - I*c) + (-I*a*
d^3/b)^(1/3)*(I*sqrt(3) + 1)*Ei(I*d*x + 1/2*(-I*a*d^3/b)^(1/3)*(-I*sqrt(3)
 - 1))*e^(1/2*(-I*a*d^3/b)^(1/3)*(I*sqrt(3) + 1) + I*c) + (I*a*d^3/b)^(1/3
)*(-I*sqrt(3) + 1)*Ei(-I*d*x + 1/2*(I*a*d^3/b)^(1/3)*(I*sqrt(3) - 1))*e^(1
/2*(I*a*d^3/b)^(1/3)*(-I*sqrt(3) + 1) - I*c) + (-I*a*d^3/b)^(1/3)*(-I*sqrt
(3) + 1)*Ei(I*d*x + 1/2*(-I*a*d^3/b)^(1/3)*(I*sqrt(3) - 1))*e^(1/2*(-I*a*d
^3/b)^(1/3)*(-I*sqrt(3) + 1) + I*c) - 2*(-I*a*d^3/b)^(1/3)*Ei(I*d*x + (-I*
a*d^3/b)^(1/3))*e^(I*c - (-I*a*d^3/b)^(1/3)) - 2*(I*a*d^3/b)^(1/3)*Ei(-I*d
*x + (I*a*d^3/b)^(1/3))*e^(-I*c - (I*a*d^3/b)^(1/3)))/(a*d)
```

### 3.98.6 Sympy [F]

$$\int \frac{\sin(c+dx)}{a+bx^3}\,dx=\int \frac{\sin(c+dx)}{a+bx^3}\,dx$$

input
```
integrate(sin(d*x+c)/(b*x**3+a),x)
```

output
```
Integral(sin(c + d*x)/(a + b*x**3), x)
```

### 3.98.7 Maxima [F]

$$\int \frac{\sin(c+dx)}{a+bx^3}\,dx = \int \frac{\sin(dx+c)}{bx^3+a}\,dx$$

input
```
integrate(sin(d*x+c)/(b*x^3+a),x, algorithm="maxima")
```

output
```
integrate(sin(d*x + c)/(b*x^3 + a), x)
```

### 3.98.8 Giac [F]

$$\int \frac{\sin(c+dx)}{a+bx^3}\,dx = \int \frac{\sin(dx+c)}{bx^3+a}\,dx$$

input
```
integrate(sin(d*x+c)/(b*x^3+a),x, algorithm="giac")
```

output
```
integrate(sin(d*x + c)/(b*x^3 + a), x)
```

### 3.98.9 Mupad [F(-1)]

Timed out.

$$\int \frac{\sin(c+dx)}{a+bx^3}\,dx = \int \frac{\sin(c+d\,x)}{b\,x^3+a}\,dx$$

input
```
int(sin(c + d*x)/(a + b*x^3),x)
```

output
```
int(sin(c + d*x)/(a + b*x^3), x)
```

# 3.99 $\int \frac{\sin(c+dx)}{x(a+bx^3)} \, dx$



## 3.99.1 Optimal result

Integrand size = 19, antiderivative size = 301

$$\int \frac{\sin(c+dx)}{x(a+bx^3)} \, dx = \frac{\text{CosIntegral}(dx)\sin(c)}{a} - \frac{\text{CosIntegral}\left(\frac{\sqrt[3]{a}d}{\sqrt[3]{b}}+dx\right)\sin\left(c-\frac{\sqrt[3]{a}d}{\sqrt[3]{b}}\right)}{3a} - \frac{\text{CosIntegral}\left(\frac{\sqrt[3]{-1}\sqrt[3]{a}d}{\sqrt[3]{b}}-dx\right)\sin\left(c+\frac{\sqrt[3]{-1}\sqrt[3]{a}d}{\sqrt[3]{b}}\right)}{3a} - \frac{\text{CosIntegral}\left(\frac{(-1)^{2/3}\sqrt[3]{a}d}{\sqrt[3]{b}}+dx\right)\sin\left(c-\frac{(-1)^{2/3}\sqrt[3]{a}d}{\sqrt[3]{b}}\right)}{3a} + \frac{\cos(c)\text{Si}(dx)}{a} + \frac{\cos\left(c+\frac{\sqrt[3]{-1}\sqrt[3]{a}d}{\sqrt[3]{b}}\right)\text{Si}\left(\frac{\sqrt[3]{-1}\sqrt[3]{a}d}{\sqrt[3]{b}}-dx\right)}{3a} - \frac{\cos\left(c-\frac{\sqrt[3]{a}d}{\sqrt[3]{b}}\right)\text{Si}\left(\frac{\sqrt[3]{a}d}{\sqrt[3]{b}}+dx\right)}{3a} - \frac{\cos\left(c-\frac{(-1)^{2/3}\sqrt[3]{a}d}{\sqrt[3]{b}}\right)\text{Si}\left(\frac{(-1)^{2/3}\sqrt[3]{a}d}{\sqrt[3]{b}}+dx\right)}{3a}$$

output
```
cos(c)*Si(d*x)/a-1/3*cos(c+(-1)^(1/3)*a^(1/3)*d/b^(1/3))*Si(-(-1)^(1/3)*a^
(1/3)*d/b^(1/3)+d*x)/a-1/3*cos(c-a^(1/3)*d/b^(1/3))*Si(a^(1/3)*d/b^(1/3)+d
*x)/a-1/3*cos(c-(-1)^(2/3)*a^(1/3)*d/b^(1/3))*Si((-1)^(2/3)*a^(1/3)*d/b^(1
/3)+d*x)/a+Ci(d*x)*sin(c)/a-1/3*Ci(a^(1/3)*d/b^(1/3)+d*x)*sin(c-a^(1/3)*d/
b^(1/3))/a-1/3*Ci((-1)^(1/3)*a^(1/3)*d/b^(1/3)-d*x)*sin(c+(-1)^(1/3)*a^(1/
3)*d/b^(1/3))/a-1/3*Ci((-1)^(2/3)*a^(1/3)*d/b^(1/3)+d*x)*sin(c-(-1)^(2/3)*
a^(1/3)*d/b^(1/3))/a
```

### 3.99.2 Mathematica [C] (verified)

Result contains higher order function than in optimal. Order 9 vs. order 4 in optimal.

Time = 0.13 (sec) , antiderivative size = 206, normalized size of antiderivative = 0.68

$$\int \frac{\sin(c+dx)}{x(a+bx^3)}\,dx$$
$$= \frac{-i\text{RootSum}\left[a+b\#1^3\&,\cos(c+d\#1)\,\text{CosIntegral}(d(x-\#1))-i\,\text{CosIntegral}(d(x-\#1))\sin(c+d\#1)\right.}{}$$

input
```
Integrate[Sin[c + d*x]/(x*(a + b*x^3)),x]
```

output
```
((-I)*RootSum[a + b*#1^3 & , Cos[c + d*#1]*CosIntegral[d*(x - #1)] - I*Cos
Integral[d*(x - #1)]*Sin[c + d*#1] - I*Cos[c + d*#1]*SinIntegral[d*(x - #1
)] - Sin[c + d*#1]*SinIntegral[d*(x - #1)] & ] + I*RootSum[a + b*#1^3 & ,
Cos[c + d*#1]*CosIntegral[d*(x - #1)] + I*CosIntegral[d*(x - #1)]*Sin[c +
d*#1] + I*Cos[c + d*#1]*SinIntegral[d*(x - #1)] - Sin[c + d*#1]*SinIntegra
l[d*(x - #1)] & ] + 6*CosIntegral[d*x]*Sin[c] + 6*Cos[c]*SinIntegral[d*x])
/(6*a)
```

### 3.99.3 Rubi [A] (verified)

Time = 0.73 (sec) , antiderivative size = 301, normalized size of antiderivative = 1.00, number of steps used = 2, number of rules used = 2, $\frac{\text{number of rules}}{\text{integrand size}} = 0.105$, Rules used = {3826, 2009}

Below are the steps used by Rubi to obtain the solution. The rule number used for the transformation is given above next to the arrow. The rules definitions used are listed below.

$$\int \frac{\sin(c+dx)}{x\left(a+bx^3\right)}\,dx$$
$$\Big\downarrow \; 3826$$
$$\int \left(\frac{\sin(c+dx)}{ax}-\frac{bx^2\sin(c+dx)}{a\left(a+bx^3\right)}\right)dx$$
$$\Big\downarrow \; 2009$$
$$-\frac{\sin\left(c-\frac{\sqrt[3]{a}d}{\sqrt[3]{b}}\right)\text{CosIntegral}\left(xd+\frac{\sqrt[3]{a}d}{\sqrt[3]{b}}\right)}{3a}-\frac{\sin\left(\frac{\sqrt[3]{-1}\sqrt[3]{a}d}{\sqrt[3]{b}}+c\right)\text{CosIntegral}\left(\frac{\sqrt[3]{-1}\sqrt[3]{a}d}{\sqrt[3]{b}}-dx\right)}{3a}-\frac{\sin\left(c-\frac{(-1)^{2/3}\sqrt[3]{a}d}{\sqrt[3]{b}}\right)\text{CosIntegral}\left(xd+\frac{(-1)^{2/3}\sqrt[3]{a}d}{\sqrt[3]{b}}\right)}{3a}+\frac{\cos\left(\frac{\sqrt[3]{-1}\sqrt[3]{a}d}{\sqrt[3]{b}}+c\right)\text{Si}\left(\frac{\sqrt[3]{-1}\sqrt[3]{a}d}{\sqrt[3]{b}}-dx\right)}{3a}-\frac{\cos\left(c-\frac{\sqrt[3]{a}d}{\sqrt[3]{b}}\right)\text{Si}\left(xd+\frac{\sqrt[3]{a}d}{\sqrt[3]{b}}\right)}{3a}-\frac{\cos\left(c-\frac{(-1)^{2/3}\sqrt[3]{a}d}{\sqrt[3]{b}}\right)\text{Si}\left(xd+\frac{(-1)^{2/3}\sqrt[3]{a}d}{\sqrt[3]{b}}\right)}{3a}+\frac{\sin(c)\,\text{CosIntegral}(dx)}{a}+\frac{\cos(c)\text{Si}(dx)}{a}$$

input
```
Int[Sin[c + d*x]/(x*(a + b*x^3)),x]
```

output
```
(CosIntegral[d*x]*Sin[c])/a - (CosIntegral[(a^(1/3)*d)/b^(1/3) + d*x]*Sin[
c - (a^(1/3)*d)/b^(1/3)])/(3*a) - (CosIntegral[((-1)^(1/3)*a^(1/3)*d)/b^(1
/3) - d*x]*Sin[c + ((-1)^(1/3)*a^(1/3)*d)/b^(1/3)])/(3*a) - (CosIntegral[(
(-1)^(2/3)*a^(1/3)*d)/b^(1/3) + d*x]*Sin[c - ((-1)^(2/3)*a^(1/3)*d)/b^(1/3
)])/(3*a) + (Cos[c]*SinIntegral[d*x])/a + (Cos[c + ((-1)^(1/3)*a^(1/3)*d)/
b^(1/3)]*SinIntegral[((-1)^(1/3)*a^(1/3)*d)/b^(1/3) - d*x])/(3*a) - (Cos[c
 - (a^(1/3)*d)/b^(1/3)]*SinIntegral[(a^(1/3)*d)/b^(1/3) + d*x])/(3*a) - (C
os[c - ((-1)^(2/3)*a^(1/3)*d)/b^(1/3)]*SinIntegral[((-1)^(2/3)*a^(1/3)*d)/
b^(1/3) + d*x])/(3*a)
```

## 3.99. $\int \frac{\sin(c+dx)}{x(a+bx^3)}\,dx$

#### 3.99.3.1 Defintions of rubi rules used

rule 2009
```
Int[u_, x_Symbol] :> Simp[IntSum[u, x], x] /; SumQ[u]
```

rule 3826
```
Int[(x_)^(m_.)*((a_) + (b_.)*(x_)^(n_))^(p_)*Sin[(c_.) + (d_.)*(x_)], x_Sym
bol] :> Int[ExpandIntegrand[Sin[c + d*x], x^m*(a + b*x^n)^p, x], x] /; Free
Q[{a, b, c, d, m}, x] && ILtQ[p, 0] && IGtQ[n, 0] && (EqQ[n, 2] || EqQ[p, -
1]) && IntegerQ[m]
```

### 3.99.4 Maple [C] (verified)

Result contains higher order function than in optimal. Order 9 vs. order 4.

Time = 0.29 (sec) , antiderivative size = 88, normalized size of antiderivative = 0.29

| method | result |
|---|---|
| derivativedivides | $\frac{\mathrm{Si}(dx)\cos(c)+\mathrm{Ci}(dx)\sin(c)}{a}-\frac{\sum_{\_R1=\mathrm{RootOf}\left(b\_Z^3-3\_Z^2bc+3c^2b\_Z+a\,d^3-c^3b\right)}\left(-\mathrm{Si}\left(-dx+\_R1-c\right)\cos\left(\_R1\right)+\right.}{3a}$ |
| default | $\frac{\mathrm{Si}(dx)\cos(c)+\mathrm{Ci}(dx)\sin(c)}{a}-\frac{\sum_{\_R1=\mathrm{RootOf}\left(b\_Z^3-3\_Z^2bc+3c^2b\_Z+a\,d^3-c^3b\right)}\left(-\mathrm{Si}\left(-dx+\_R1-c\right)\cos\left(\_R1\right)+\right.}{3a}$ |
| risch | $-\frac{i\left(\sum_{\_R1=\mathrm{RootOf}\left(-3i\_Z^2bc-id^3a+ib\,c^3+b\_Z^3-3c^2b\_Z\right)}\mathrm{e}^{\_R1}\mathrm{Ei}_1\left(-idx-ic+\_R1\right)\right)}{6a}+\frac{i\mathrm{e}^{ic}\mathrm{Ei}_1(-idx)}{2a}+\frac{i\left(\right.}{}$ |

input
```
int(sin(d*x+c)/x/(b*x^3+a),x,method=_RETURNVERBOSE)
```

output
```
1/a*(Si(d*x)*cos(c)+Ci(d*x)*sin(c))-1/3/a*sum(-Si(-d*x+_R1-c)*cos(_R1)+Ci(
d*x-_R1+c)*sin(_R1),_R1=RootOf(_Z^3*b-3*_Z^2*b*c+3*_Z*b*c^2+a*d^3-b*c^3))
```

### 3.99.5 Fricas [C] (verification not implemented)

Result contains complex when optimal does not.

Time = 0.35 (sec) , antiderivative size = 308, normalized size of antiderivative = 1.02

$$\int \frac{\sin(c+dx)}{x(a+bx^3)}\,dx$$
$$= \frac{-i\,\mathrm{Ei}\left(-i\,dx+\frac{1}{2}\left(\frac{i\,ad^3}{b}\right)^{\frac{1}{3}}\left(-i\sqrt{3}-1\right)\right)e^{\left(\frac{1}{2}\left(\frac{i\,ad^3}{b}\right)^{\frac{1}{3}}\left(i\sqrt{3}+1\right)-i\,c\right)}+i\,\mathrm{Ei}\left(i\,dx+\frac{1}{2}\left(-\frac{i\,ad^3}{b}\right)^{\frac{1}{3}}\left(-i\sqrt{3}-1\right)\right)}{}$$

input
```
integrate(sin(d*x+c)/x/(b*x^3+a),x, algorithm="fricas")
```

output
```
1/6*(-I*Ei(-I*d*x + 1/2*(I*a*d^3/b)^(1/3)*(-I*sqrt(3) - 1))*e^(1/2*(I*a*d^
3/b)^(1/3)*(I*sqrt(3) + 1) - I*c) + I*Ei(I*d*x + 1/2*(-I*a*d^3/b)^(1/3)*(-
I*sqrt(3) - 1))*e^(1/2*(-I*a*d^3/b)^(1/3)*(I*sqrt(3) + 1) + I*c) - I*Ei(-I
*d*x + 1/2*(I*a*d^3/b)^(1/3)*(I*sqrt(3) - 1))*e^(1/2*(I*a*d^3/b)^(1/3)*(-I
*sqrt(3) + 1) - I*c) + I*Ei(I*d*x + 1/2*(-I*a*d^3/b)^(1/3)*(I*sqrt(3) - 1)
)*e^(1/2*(-I*a*d^3/b)^(1/3)*(-I*sqrt(3) + 1) + I*c) + I*Ei(I*d*x + (-I*a*d
^3/b)^(1/3))*e^(I*c - (-I*a*d^3/b)^(1/3)) - I*Ei(-I*d*x + (I*a*d^3/b)^(1/3
))*e^(-I*c - (I*a*d^3/b)^(1/3)) + 6*cos_integral(d*x)*sin(c) + 6*cos(c)*si
n_integral(d*x))/a
```

### 3.99.6 Sympy [F]

$$\int \frac{\sin(c+dx)}{x(a+bx^3)}\,dx = \int \frac{\sin\left(c+dx\right)}{x\left(a+bx^3\right)}\,dx$$

input
```
integrate(sin(d*x+c)/x/(b*x**3+a),x)
```

output
```
Integral(sin(c + d*x)/(x*(a + b*x**3)), x)
```

## 3.99.7 Maxima [F]

$$\int \frac{\sin(c+dx)}{x(a+bx^3)}\,dx = \int \frac{\sin(dx+c)}{(bx^3+a)x}\,dx$$

input
```
integrate(sin(d*x+c)/x/(b*x^3+a),x, algorithm="maxima")
```

output
```
integrate(sin(d*x + c)/((b*x^3 + a)*x), x)
```

## 3.99.8 Giac [F]

$$\int \frac{\sin(c+dx)}{x(a+bx^3)}\,dx = \int \frac{\sin(dx+c)}{(bx^3+a)x}\,dx$$

input
```
integrate(sin(d*x+c)/x/(b*x^3+a),x, algorithm="giac")
```

output
```
integrate(sin(d*x + c)/((b*x^3 + a)*x), x)
```

## 3.99.9 Mupad [F(-1)]

Timed out.

$$\int \frac{\sin(c+dx)}{x(a+bx^3)}\,dx = \int \frac{\sin(c+d\,x)}{x\,(b\,x^3+a)}\,dx$$

input
```
int(sin(c + d*x)/(x*(a + b*x^3)),x)
```

output
```
int(sin(c + d*x)/(x*(a + b*x^3)), x)
```

# 3.100 $\int \frac{\sin(c+dx)}{x^2(a+bx^3)}\,dx$



## 3.100.1 Optimal result

Integrand size = 19, antiderivative size = 380

$$\begin{aligned}\int \frac{\sin(c+dx)}{x^2(a+bx^3)}\,dx &= \frac{d\cos(c)\operatorname{CosIntegral}(dx)}{a} \\ &+ \frac{\sqrt[3]{b}\operatorname{CosIntegral}\left(\frac{\sqrt[3]{a}d}{\sqrt[3]{b}}+dx\right)\sin\left(c-\frac{\sqrt[3]{a}d}{\sqrt[3]{b}}\right)}{3a^{4/3}} \\ &+ \frac{(-1)^{2/3}\sqrt[3]{b}\operatorname{CosIntegral}\left(\frac{\sqrt[3]{-1}\sqrt[3]{a}d}{\sqrt[3]{b}}-dx\right)\sin\left(c+\frac{\sqrt[3]{-1}\sqrt[3]{a}d}{\sqrt[3]{b}}\right)}{3a^{4/3}} \\ &- \frac{\sqrt[3]{-1}\sqrt[3]{b}\operatorname{CosIntegral}\left(\frac{(-1)^{2/3}\sqrt[3]{a}d}{\sqrt[3]{b}}+dx\right)\sin\left(c-\frac{(-1)^{2/3}\sqrt[3]{a}d}{\sqrt[3]{b}}\right)}{3a^{4/3}} \\ &- \frac{\sin(c+dx)}{ax} - \frac{d\sin(c)\operatorname{Si}(dx)}{a} \\ &- \frac{(-1)^{2/3}\sqrt[3]{b}\cos\left(c+\frac{\sqrt[3]{-1}\sqrt[3]{a}d}{\sqrt[3]{b}}\right)\operatorname{Si}\left(\frac{\sqrt[3]{-1}\sqrt[3]{a}d}{\sqrt[3]{b}}-dx\right)}{3a^{4/3}} \\ &+ \frac{\sqrt[3]{b}\cos\left(c-\frac{\sqrt[3]{a}d}{\sqrt[3]{b}}\right)\operatorname{Si}\left(\frac{\sqrt[3]{a}d}{\sqrt[3]{b}}+dx\right)}{3a^{4/3}} \\ &- \frac{\sqrt[3]{-1}\sqrt[3]{b}\cos\left(c-\frac{(-1)^{2/3}\sqrt[3]{a}d}{\sqrt[3]{b}}\right)\operatorname{Si}\left(\frac{(-1)^{2/3}\sqrt[3]{a}d}{\sqrt[3]{b}}+dx\right)}{3a^{4/3}}\end{aligned}$$

output
```
d*Ci(d*x)*cos(c)/a+1/3*(-1)^(2/3)*b^(1/3)*cos(c+(-1)^(1/3)*a^(1/3)*d/b^(1/
3))*Si(-(-1)^(1/3)*a^(1/3)*d/b^(1/3)+d*x)/a^(4/3)+1/3*b^(1/3)*cos(c-a^(1/3
)*d/b^(1/3))*Si(a^(1/3)*d/b^(1/3)+d*x)/a^(4/3)-1/3*(-1)^(1/3)*b^(1/3)*cos(
c-(-1)^(2/3)*a^(1/3)*d/b^(1/3))*Si((-1)^(2/3)*a^(1/3)*d/b^(1/3)+d*x)/a^(4/
3)-d*Si(d*x)*sin(c)/a+1/3*b^(1/3)*Ci(a^(1/3)*d/b^(1/3)+d*x)*sin(c-a^(1/3)*
d/b^(1/3))/a^(4/3)+1/3*(-1)^(2/3)*b^(1/3)*Ci((-1)^(1/3)*a^(1/3)*d/b^(1/3)-
d*x)*sin(c+(-1)^(1/3)*a^(1/3)*d/b^(1/3))/a^(4/3)-1/3*(-1)^(1/3)*b^(1/3)*Ci
((-1)^(2/3)*a^(1/3)*d/b^(1/3)+d*x)*sin(c-(-1)^(2/3)*a^(1/3)*d/b^(1/3))/a^(
4/3)-sin(d*x+c)/a/x
```

### 3.100.2 Mathematica [C] (verified)

Result contains higher order function than in optimal. Order 9 vs. order 4 in optimal.

Time = 0.18 (sec) , antiderivative size = 233, normalized size of antiderivative = 0.61

$$\int \frac{\sin(c+dx)}{x^2(a+bx^3)}\,dx$$
$$= \frac{6dx\cos(c)\,\text{CosIntegral}(dx) - ix\text{RootSum}\left[a+b\#1^3\&, \frac{\cos(c+d\#1)\,\text{CosIntegral}(d(x-\#1))-i\,\text{CosIntegral}(d(x-\#1))\sin(}{}\right.}{}$$

input
```
Integrate[Sin[c + d*x]/(x^2*(a + b*x^3)),x]
```

output
```
(6*d*x*Cos[c]*CosIntegral[d*x] - I*x*RootSum[a + b*#1^3 & , (Cos[c + d*#1]
*CosIntegral[d*(x - #1)] - I*CosIntegral[d*(x - #1)]*Sin[c + d*#1] - I*Cos
[c + d*#1]*SinIntegral[d*(x - #1)] - Sin[c + d*#1]*SinIntegral[d*(x - #1)]
)/#1 & ] + I*x*RootSum[a + b*#1^3 & , (Cos[c + d*#1]*CosIntegral[d*(x - #1
)] + I*CosIntegral[d*(x - #1)]*Sin[c + d*#1] + I*Cos[c + d*#1]*SinIntegral
[d*(x - #1)] - Sin[c + d*#1]*SinIntegral[d*(x - #1)])/#1 & ] - 6*Sin[c + d
*x] - 6*d*x*Sin[c]*SinIntegral[d*x])/(6*a*x)
```

### 3.100.3 Rubi [A] (verified)

Time = 0.79 (sec) , antiderivative size = 380, normalized size of antiderivative = 1.00, number of steps used = 2, number of rules used = 2, $\frac{\text{number of rules}}{\text{integrand size}}$ = 0.105, Rules used = {3826, 2009}

Below are the steps used by Rubi to obtain the solution. The rule number used for the transformation is given above next to the arrow. The rules definitions used are listed below.

$$\int \frac{\sin(c+dx)}{x^2(a+bx^3)}\,dx$$

$$\Big\downarrow \text{3826}$$

$$\int \left(\frac{\sin(c+dx)}{ax^2}-\frac{bx\sin(c+dx)}{a(a+bx^3)}\right)dx$$

$$\Big\downarrow \text{2009}$$

$$\frac{\sqrt[3]{b}\sin\left(c-\frac{\sqrt[3]{a}d}{\sqrt[3]{b}}\right)\text{CosIntegral}\left(xd+\frac{\sqrt[3]{a}d}{\sqrt[3]{b}}\right)}{3a^{4/3}}+\frac{(-1)^{2/3}\sqrt[3]{b}\sin\left(\frac{\sqrt[3]{-1}\sqrt[3]{a}d}{\sqrt[3]{b}}+c\right)\text{CosIntegral}\left(\frac{\sqrt[3]{-1}\sqrt[3]{a}d}{\sqrt[3]{b}}-dx\right)}{3a^{4/3}}-\frac{\sqrt[3]{-1}\sqrt[3]{b}\sin\left(c-\frac{(-1)^{2/3}\sqrt[3]{a}d}{\sqrt[3]{b}}\right)\text{CosIntegral}\left(xd+\frac{(-1)^{2/3}\sqrt[3]{a}d}{\sqrt[3]{b}}\right)}{3a^{4/3}}-\frac{(-1)^{2/3}\sqrt[3]{b}\cos\left(\frac{\sqrt[3]{-1}\sqrt[3]{a}d}{\sqrt[3]{b}}+c\right)\text{Si}\left(\frac{\sqrt[3]{-1}\sqrt[3]{a}d}{\sqrt[3]{b}}-dx\right)}{3a^{4/3}}+\frac{\sqrt[3]{b}\cos\left(c-\frac{\sqrt[3]{a}d}{\sqrt[3]{b}}\right)\text{Si}\left(xd+\frac{\sqrt[3]{a}d}{\sqrt[3]{b}}\right)}{3a^{4/3}}-\frac{\sqrt[3]{-1}\sqrt[3]{b}\cos\left(c-\frac{(-1)^{2/3}\sqrt[3]{a}d}{\sqrt[3]{b}}\right)\text{Si}\left(xd+\frac{(-1)^{2/3}\sqrt[3]{a}d}{\sqrt[3]{b}}\right)}{3a^{4/3}}+\frac{d\cos(c)\text{CosIntegral}(dx)}{a}-\frac{d\sin(c)\text{Si}(dx)}{a}-\frac{\sin(c+dx)}{ax}$$

input
```
Int[Sin[c + d*x]/(x^2*(a + b*x^3)),x]
```

output
```
(d*Cos[c]*CosIntegral[d*x])/a + (b^(1/3)*CosIntegral[(a^(1/3)*d)/b^(1/3) +
 d*x]*Sin[c - (a^(1/3)*d)/b^(1/3)])/(3*a^(4/3)) + ((-1)^(2/3)*b^(1/3)*CosI
ntegral[((-1)^(1/3)*a^(1/3)*d)/b^(1/3) - d*x]*Sin[c + ((-1)^(1/3)*a^(1/3)*
d)/b^(1/3)])/(3*a^(4/3)) - ((-1)^(1/3)*b^(1/3)*CosIntegral[((-1)^(2/3)*a^(
1/3)*d)/b^(1/3) + d*x]*Sin[c - ((-1)^(2/3)*a^(1/3)*d)/b^(1/3)])/(3*a^(4/3)
) - Sin[c + d*x]/(a*x) - (d*Sin[c]*SinIntegral[d*x])/a - ((-1)^(2/3)*b^(1/
3)*Cos[c + ((-1)^(1/3)*a^(1/3)*d)/b^(1/3)]*SinIntegral[((-1)^(1/3)*a^(1/3)
*d)/b^(1/3) - d*x])/(3*a^(4/3)) + (b^(1/3)*Cos[c - (a^(1/3)*d)/b^(1/3)]*Si
nIntegral[(a^(1/3)*d)/b^(1/3) + d*x])/(3*a^(4/3)) - ((-1)^(1/3)*b^(1/3)*Co
s[c - ((-1)^(2/3)*a^(1/3)*d)/b^(1/3)]*SinIntegral[((-1)^(2/3)*a^(1/3)*d)/b
^(1/3) + d*x])/(3*a^(4/3))
```

### 3.100.3.1 Defintions of rubi rules used

rule 2009
```
Int[u_, x_Symbol] :> Simp[IntSum[u, x], x] /; SumQ[u]
```

rule 3826
```
Int[(x_)^(m_.)*((a_) + (b_.)*(x_)^(n_))^(p_)*Sin[(c_.) + (d_.)*(x_)], x_Sym
bol] :> Int[ExpandIntegrand[Sin[c + d*x], x^m*(a + b*x^n)^p, x], x] /; Free
Q[{a, b, c, d, m}, x] && ILtQ[p, 0] && IGtQ[n, 0] && (EqQ[n, 2] || EqQ[p, -
1]) && IntegerQ[m]
```

## 3.100.4 Maple [C] (verified)

Result contains higher order function than in optimal. Order 9 vs. order 4.

Time = 0.41 (sec) , antiderivative size = 116, normalized size of antiderivative = 0.31

| method | result |
|---|---|
| derivativedivides | $d\left(-\frac{\sin(dx+c)}{adx}+\frac{\sum_{\_R1=\mathrm{RootOf}\left(b\_Z^3-3\_Z^2bc+3c^2b\_Z+a\,d^3-c^3b\right)}\frac{-\mathrm{Si}\left(-dx+\_R1-c\right)\cos\left(\_R1\right)+\mathrm{Ci}\left(dx-\_R1\right.}{-\_R1+c}}{3a}\right.$ |
| default | $d\left(-\frac{\sin(dx+c)}{adx}+\frac{\sum_{\_R1=\mathrm{RootOf}\left(b\_Z^3-3\_Z^2bc+3c^2b\_Z+a\,d^3-c^3b\right)}\frac{-\mathrm{Si}\left(-dx+\_R1-c\right)\cos\left(\_R1\right)+\mathrm{Ci}\left(dx-\_R1\right.}{-\_R1+c}}{3a}\right.$ |
| risch | $-\frac{d\,\mathrm{Ei}_1(-idx)\mathrm{e}^{ic}}{2a}+\frac{d\left(\sum_{\_R1=\mathrm{RootOf}\left(-3i\_Z^2bc-id^3a+ibc^3+b\_Z^3-3c^2b\_Z\right)}\frac{\mathrm{e}^{\_R1}\,\mathrm{Ei}_1\left(-idx-ic+\_R1\right)}{-ic+\_R1}\right)}{6a}-\frac{d\,\mathrm{Ei}_1}{}$ |

input
```
int(sin(d*x+c)/x^2/(b*x^3+a),x,method=_RETURNVERBOSE)
```

output
```
d*(-sin(d*x+c)/a/d/x+1/3/a*sum(1/(-_R1+c)*(-Si(-d*x+_R1-c)*cos(_R1)+Ci(d*x
-_R1+c)*sin(_R1)),_R1=RootOf(_Z^3*b-3*_Z^2*b*c+3*_Z*b*c^2+a*d^3-b*c^3))+1/
a*(-Si(d*x)*sin(c)+Ci(d*x)*cos(c)))
```

## 3.100.5 Fricas [C] (verification not implemented)

Result contains complex when optimal does not.

Time = 0.31 (sec) , antiderivative size = 448, normalized size of antiderivative = 1.18

$$\int \frac{\sin(c+dx)}{x^2(a+bx^3)}\,dx$$

$$=\frac{12\,ad^3x\cos\left(c\right)\mathrm{Ci}\left(dx\right)-12\,ad^3x\sin\left(c\right)\mathrm{Si}\left(dx\right)+2i\left(-\frac{i\,ad^3}{b}\right)^{\frac{2}{3}}bx\mathrm{Ei}\left(i\,dx+\left(-\frac{i\,ad^3}{b}\right)^{\frac{1}{3}}\right)e^{\left(i\,c-\left(-\frac{i\,ad^3}{b}\right)^{\frac{1}{3}}\right)}-}{}$$

input
```
integrate(sin(d*x+c)/x^2/(b*x^3+a),x, algorithm="fricas")
```

output
```
1/12*(12*a*d^3*x*cos(c)*cos_integral(d*x) - 12*a*d^3*x*sin(c)*sin_integral
(d*x) + 2*I*(-I*a*d^3/b)^(2/3)*b*x*Ei(I*d*x + (-I*a*d^3/b)^(1/3))*e^(I*c -
 (-I*a*d^3/b)^(1/3)) - 2*I*(I*a*d^3/b)^(2/3)*b*x*Ei(-I*d*x + (I*a*d^3/b)^(
1/3))*e^(-I*c - (I*a*d^3/b)^(1/3)) - 12*a*d^2*sin(d*x + c) + (I*a*d^3/b)^(
2/3)*(sqrt(3)*b*x + I*b*x)*Ei(-I*d*x + 1/2*(I*a*d^3/b)^(1/3)*(-I*sqrt(3) -
 1))*e^(1/2*(I*a*d^3/b)^(1/3)*(I*sqrt(3) + 1) - I*c) - (-I*a*d^3/b)^(2/3)*
(sqrt(3)*b*x + I*b*x)*Ei(I*d*x + 1/2*(-I*a*d^3/b)^(1/3)*(-I*sqrt(3) - 1))*
e^(1/2*(-I*a*d^3/b)^(1/3)*(I*sqrt(3) + 1) + I*c) - (I*a*d^3/b)^(2/3)*(sqrt
(3)*b*x - I*b*x)*Ei(-I*d*x + 1/2*(I*a*d^3/b)^(1/3)*(I*sqrt(3) - 1))*e^(1/2
*(I*a*d^3/b)^(1/3)*(-I*sqrt(3) + 1) - I*c) + (-I*a*d^3/b)^(2/3)*(sqrt(3)*b
*x - I*b*x)*Ei(I*d*x + 1/2*(-I*a*d^3/b)^(1/3)*(I*sqrt(3) - 1))*e^(1/2*(-I*
a*d^3/b)^(1/3)*(-I*sqrt(3) + 1) + I*c))/(a^2*d^2*x)
```

### 3.100.6 Sympy [F]

$$\int \frac{\sin(c+dx)}{x^2(a+bx^3)}\,dx = \int \frac{\sin(c+dx)}{x^2(a+bx^3)}\,dx$$

input
```
integrate(sin(d*x+c)/x**2/(b*x**3+a),x)
```

output
```
Integral(sin(c + d*x)/(x**2*(a + b*x**3)), x)
```

### 3.100.7 Maxima [F]

$$\int \frac{\sin(c+dx)}{x^2(a+bx^3)}\,dx = \int \frac{\sin(dx+c)}{(bx^3+a)x^2}\,dx$$

input
```
integrate(sin(d*x+c)/x^2/(b*x^3+a),x, algorithm="maxima")
```

output
```
integrate(sin(d*x + c)/((b*x^3 + a)*x^2), x)
```

### 3.100.8 Giac [F]

$$\int \frac{\sin(c+dx)}{x^2(a+bx^3)}\,dx = \int \frac{\sin(dx+c)}{(bx^3+a)x^2}\,dx$$

input
```
integrate(sin(d*x+c)/x^2/(b*x^3+a),x, algorithm="giac")
```

output
```
integrate(sin(d*x + c)/((b*x^3 + a)*x^2), x)
```

### 3.100.9 Mupad [F(-1)]

Timed out.

$$\int \frac{\sin(c+dx)}{x^2(a+bx^3)}\,dx = \int \frac{\sin(c+d\,x)}{x^2\,(b\,x^3+a)}\,dx$$

input
```
int(sin(c + d*x)/(x^2*(a + b*x^3)),x)
```

output
```
int(sin(c + d*x)/(x^2*(a + b*x^3)), x)
```

# 3.101 $\int \frac{\sin(c+dx)}{x^3(a+bx^3)}\,dx$



## 3.101.1 Optimal result

Integrand size = 19, antiderivative size = 408

$$\begin{aligned}
\int \frac{\sin(c+dx)}{x^3(a+bx^3)}\,dx = &-\frac{d\cos(c+dx)}{2ax}-\frac{d^2\operatorname{CosIntegral}(dx)\sin(c)}{2a}\\
&-\frac{b^{2/3}\operatorname{CosIntegral}\left(\frac{\sqrt[3]{a}d}{\sqrt[3]{b}}+dx\right)\sin\left(c-\frac{\sqrt[3]{a}d}{\sqrt[3]{b}}\right)}{3a^{5/3}}\\
&+\frac{\sqrt[3]{-1}b^{2/3}\operatorname{CosIntegral}\left(\frac{\sqrt[3]{-1}\sqrt[3]{a}d}{\sqrt[3]{b}}-dx\right)\sin\left(c+\frac{\sqrt[3]{-1}\sqrt[3]{a}d}{\sqrt[3]{b}}\right)}{3a^{5/3}}\\
&-\frac{(-1)^{2/3}b^{2/3}\operatorname{CosIntegral}\left(\frac{(-1)^{2/3}\sqrt[3]{a}d}{\sqrt[3]{b}}+dx\right)\sin\left(c-\frac{(-1)^{2/3}\sqrt[3]{a}d}{\sqrt[3]{b}}\right)}{3a^{5/3}}\\
&-\frac{\sin(c+dx)}{2ax^2}-\frac{d^2\cos(c)\operatorname{Si}(dx)}{2a}\\
&-\frac{\sqrt[3]{-1}b^{2/3}\cos\left(c+\frac{\sqrt[3]{-1}\sqrt[3]{a}d}{\sqrt[3]{b}}\right)\operatorname{Si}\left(\frac{\sqrt[3]{-1}\sqrt[3]{a}d}{\sqrt[3]{b}}-dx\right)}{3a^{5/3}}\\
&-\frac{b^{2/3}\cos\left(c-\frac{\sqrt[3]{a}d}{\sqrt[3]{b}}\right)\operatorname{Si}\left(\frac{\sqrt[3]{a}d}{\sqrt[3]{b}}+dx\right)}{3a^{5/3}}\\
&-\frac{(-1)^{2/3}b^{2/3}\cos\left(c-\frac{(-1)^{2/3}\sqrt[3]{a}d}{\sqrt[3]{b}}\right)\operatorname{Si}\left(\frac{(-1)^{2/3}\sqrt[3]{a}d}{\sqrt[3]{b}}+dx\right)}{3a^{5/3}}
\end{aligned}$$

output
```
-1/2*d*cos(d*x+c)/a/x-1/2*d^2*cos(c)*Si(d*x)/a+1/3*(-1)^(1/3)*b^(2/3)*cos(
c+(-1)^(1/3)*a^(1/3)*d/b^(1/3))*Si(-(-1)^(1/3)*a^(1/3)*d/b^(1/3)+d*x)/a^(5
/3)-1/3*b^(2/3)*cos(c-a^(1/3)*d/b^(1/3))*Si(a^(1/3)*d/b^(1/3)+d*x)/a^(5/3)
-1/3*(-1)^(2/3)*b^(2/3)*cos(c-(-1)^(2/3)*a^(1/3)*d/b^(1/3))*Si((-1)^(2/3)*
a^(1/3)*d/b^(1/3)+d*x)/a^(5/3)-1/2*d^2*Ci(d*x)*sin(c)/a-1/3*b^(2/3)*Ci(a^(
1/3)*d/b^(1/3)+d*x)*sin(c-a^(1/3)*d/b^(1/3))/a^(5/3)+1/3*(-1)^(1/3)*b^(2/3
)*Ci((-1)^(1/3)*a^(1/3)*d/b^(1/3)-d*x)*sin(c+(-1)^(1/3)*a^(1/3)*d/b^(1/3))
/a^(5/3)-1/3*(-1)^(2/3)*b^(2/3)*Ci((-1)^(2/3)*a^(1/3)*d/b^(1/3)+d*x)*sin(c
-(-1)^(2/3)*a^(1/3)*d/b^(1/3))/a^(5/3)-1/2*sin(d*x+c)/a/x^2
```

### 3.101.2 Mathematica [C] (verified)

Result contains higher order function than in optimal. Order 9 vs. order 4 in optimal.

Time = 0.23 (sec) , antiderivative size = 253, normalized size of antiderivative = 0.62

$$\int \frac{\sin(c+dx)}{x^3(a+bx^3)}\,dx$$
$$= \frac{-ix^2\text{RootSum}\left[a+b\#1^3\&,\frac{\cos(c+d\#1)\,\text{CosIntegral}(d(x-\#1))-i\,\text{CosIntegral}(d(x-\#1))\sin(c+d\#1)-i\cos(c+d\#1)\text{Si}(d(x-\#}{\#1^2}\right.}{}$$

input
```
Integrate[Sin[c + d*x]/(x^3*(a + b*x^3)),x]
```

output
```
((-I)*x^2*RootSum[a + b*#1^3 & , (Cos[c + d*#1]*CosIntegral[d*(x - #1)] -
I*CosIntegral[d*(x - #1)]*Sin[c + d*#1] - I*Cos[c + d*#1]*SinIntegral[d*(x
 - #1)] - Sin[c + d*#1]*SinIntegral[d*(x - #1)])/#1^2 & ] + I*x^2*RootSum[
a + b*#1^3 & , (Cos[c + d*#1]*CosIntegral[d*(x - #1)] + I*CosIntegral[d*(x
 - #1)]*Sin[c + d*#1] + I*Cos[c + d*#1]*SinIntegral[d*(x - #1)] - Sin[c +
d*#1]*SinIntegral[d*(x - #1)])/#1^2 & ] - 3*(d*x*Cos[c + d*x] + d^2*x^2*Co
sIntegral[d*x]*Sin[c] + Sin[c + d*x] + d^2*x^2*Cos[c]*SinIntegral[d*x]))/(
6*a*x^2)
```

### 3.101.3 Rubi [A] (verified)

Time = 0.86 (sec) , antiderivative size = 408, normalized size of antiderivative = 1.00, number of steps used = 2, number of rules used = 2, $\frac{\text{number of rules}}{\text{integrand size}}$ = 0.105, Rules used = {3826, 2009}

Below are the steps used by Rubi to obtain the solution. The rule number used for the transformation is given above next to the arrow. The rules definitions used are listed below.

$$\int \frac{\sin(c+dx)}{x^3(a+bx^3)}dx$$

$$\Big\downarrow \text{3826}$$

$$\int \left(\frac{\sin(c+dx)}{ax^3}-\frac{b\sin(c+dx)}{a(a+bx^3)}\right)dx$$

$$\Big\downarrow \text{2009}$$

$$-\frac{b^{2/3}\sin\left(c-\frac{\sqrt[3]{a}d}{\sqrt[3]{b}}\right)\text{CosIntegral}\left(xd+\frac{\sqrt[3]{a}d}{\sqrt[3]{b}}\right)}{3a^{5/3}}+\frac{\sqrt[3]{-1}b^{2/3}\sin\left(\frac{\sqrt[3]{-1}\sqrt[3]{a}d}{\sqrt[3]{b}}+c\right)\text{CosIntegral}\left(\frac{\sqrt[3]{-1}\sqrt[3]{a}d}{\sqrt[3]{b}}-dx\right)}{3a^{5/3}}-\frac{(-1)^{2/3}b^{2/3}\sin\left(c-\frac{(-1)^{2/3}\sqrt[3]{a}d}{\sqrt[3]{b}}\right)\text{CosIntegral}\left(xd+\frac{(-1)^{2/3}\sqrt[3]{a}d}{\sqrt[3]{b}}\right)}{3a^{5/3}}-\frac{\sqrt[3]{-1}b^{2/3}\cos\left(\frac{\sqrt[3]{-1}\sqrt[3]{a}d}{\sqrt[3]{b}}+c\right)\text{Si}\left(\frac{\sqrt[3]{-1}\sqrt[3]{a}d}{\sqrt[3]{b}}-dx\right)}{3a^{5/3}}-\frac{b^{2/3}\cos\left(c-\frac{\sqrt[3]{a}d}{\sqrt[3]{b}}\right)\text{Si}\left(xd+\frac{\sqrt[3]{a}d}{\sqrt[3]{b}}\right)}{3a^{5/3}}-\frac{(-1)^{2/3}b^{2/3}\cos\left(c-\frac{(-1)^{2/3}\sqrt[3]{a}d}{\sqrt[3]{b}}\right)\text{Si}\left(xd+\frac{(-1)^{2/3}\sqrt[3]{a}d}{\sqrt[3]{b}}\right)}{3a^{5/3}}-\frac{d^2\sin(c)\text{CosIntegral}(dx)}{2a}-\frac{d^2\cos(c)\text{Si}(dx)}{2a}-\frac{\sin(c+dx)}{2ax^2}-\frac{d\cos(c+dx)}{2ax}$$

input
```
Int[Sin[c + d*x]/(x^3*(a + b*x^3)),x]
```

output
```
-1/2*(d*Cos[c + d*x])/(a*x) - (d^2*CosIntegral[d*x]*Sin[c])/(2*a) - (b^(2/
3)*CosIntegral[(a^(1/3)*d)/b^(1/3) + d*x]*Sin[c - (a^(1/3)*d)/b^(1/3)])/(3
*a^(5/3)) + ((-1)^(1/3)*b^(2/3)*CosIntegral[((-1)^(1/3)*a^(1/3)*d)/b^(1/3)
 - d*x]*Sin[c + ((-1)^(1/3)*a^(1/3)*d)/b^(1/3)])/(3*a^(5/3)) - ((-1)^(2/3)
*b^(2/3)*CosIntegral[((-1)^(2/3)*a^(1/3)*d)/b^(1/3) + d*x]*Sin[c - ((-1)^(
2/3)*a^(1/3)*d)/b^(1/3)])/(3*a^(5/3)) - Sin[c + d*x]/(2*a*x^2) - (d^2*Cos[
c]*SinIntegral[d*x])/(2*a) - ((-1)^(1/3)*b^(2/3)*Cos[c + ((-1)^(1/3)*a^(1/
3)*d)/b^(1/3)]*SinIntegral[((-1)^(1/3)*a^(1/3)*d)/b^(1/3) - d*x])/(3*a^(5/
3)) - (b^(2/3)*Cos[c - (a^(1/3)*d)/b^(1/3)]*SinIntegral[(a^(1/3)*d)/b^(1/3
) + d*x])/(3*a^(5/3)) - ((-1)^(2/3)*b^(2/3)*Cos[c - ((-1)^(2/3)*a^(1/3)*d)
/b^(1/3)]*SinIntegral[((-1)^(2/3)*a^(1/3)*d)/b^(1/3) + d*x])/(3*a^(5/3))
```

### 3.101.3.1 Defintions of rubi rules used

rule 2009
```
Int[u_, x_Symbol] :> Simp[IntSum[u, x], x] /; SumQ[u]
```

rule 3826
```
Int[(x_)^(m_.)*((a_) + (b_.)*(x_)^(n_))^(p_)*Sin[(c_.) + (d_.)*(x_)], x_Sym
bol] :> Int[ExpandIntegrand[Sin[c + d*x], x^m*(a + b*x^n)^p, x], x] /; Free
Q[{a, b, c, d, m}, x] && ILtQ[p, 0] && IGtQ[n, 0] && (EqQ[n, 2] || EqQ[p, -
1]) && IntegerQ[m]
```

## 3.101.4 Maple [C] (verified)

Result contains higher order function than in optimal. Order 9 vs. order 4.

Time = 0.45 (sec) , antiderivative size = 136, normalized size of antiderivative = 0.33

| method | result |
|---|---|
| derivativedivides | $d^2\left(\frac{-\frac{\sin(dx+c)}{2d^2x^2}-\frac{\cos(dx+c)}{2dx}-\frac{\mathrm{Si}(dx)\cos(c)}{2}-\frac{\mathrm{Ci}(dx)\sin(c)}{2}}{a}-\frac{\sum_{\_R1=\mathrm{RootOf}\left(b\_Z^3-3\_Z^2bc+3c^2b\_Z+a\,d^3-c^3b\right)}\frac{-\mathrm{Si}\left(-dx \cdots\right.}{\cdots}}{3a \cdots}\right.$ |
| default | $d^2\left(\frac{-\frac{\sin(dx+c)}{2d^2x^2}-\frac{\cos(dx+c)}{2dx}-\frac{\mathrm{Si}(dx)\cos(c)}{2}-\frac{\mathrm{Ci}(dx)\sin(c)}{2}}{a}-\frac{\sum_{\_R1=\mathrm{RootOf}\left(b\_Z^3-3\_Z^2bc+3c^2b\_Z+a\,d^3-c^3b\right)}\frac{-\mathrm{Si}\left(-dx \cdots\right.}{\cdots}}{3a \cdots}\right.$ |
| risch | $-\frac{id^2\,\mathrm{Ei}_1(-idx)\mathrm{e}^{ic}}{4a}+\frac{id^2\left(\sum_{\_R1=\mathrm{RootOf}\left(-3i\_Z^2bc-id^3a+ib\,c^3+b\_Z^3-3c^2b\_Z\right)}\frac{\mathrm{e}^{\_R1}\,\mathrm{Ei}_1\left(-idx-ic+\_R1\right)}{-2ic\_R1+\_R1^2-c^2}\right)}{6a}+\frac{id \cdots}{\cdots}$ |

input
```
int(sin(d*x+c)/x^3/(b*x^3+a),x,method=_RETURNVERBOSE)
```

output
```
d^2*(1/a*(-1/2*sin(d*x+c)/d^2/x^2-1/2*cos(d*x+c)/d/x-1/2*Si(d*x)*cos(c)-1/
2*Ci(d*x)*sin(c))-1/3/a*sum(1/(_R1^2-2*_R1*c+c^2)*(-Si(-d*x+_R1-c)*cos(_R1
)+Ci(d*x-_R1+c)*sin(_R1)),_R1=RootOf(_Z^3*b-3*_Z^2*b*c+3*_Z*b*c^2+a*d^3-b*
c^3)))
```

### 3.101.5 Fricas [C] (verification not implemented)

Result contains complex when optimal does not.

Time = 0.30 (sec) , antiderivative size = 489, normalized size of antiderivative = 1.20

$$\int \frac{\sin(c+dx)}{x^3\,(a+bx^3)}\,dx =$$

$$-\frac{6\,ad^3x^2\,\mathrm{Ci}\,(dx)\sin\,(c)+6\,ad^3x^2\cos\,(c)\,\mathrm{Si}\,(dx)-2\left(-\frac{i\,ad^3}{b}\right)^{\frac{1}{3}}bx^2\mathrm{Ei}\left(i\,dx+\left(-\frac{i\,ad^3}{b}\right)^{\frac{1}{3}}\right)e^{\left(i\,c-\left(-\frac{i\,ad^3}{b}\right)^{\frac{1}{3}}\right)} \cdots}{\cdots}$$

input
```
integrate(sin(d*x+c)/x^3/(b*x^3+a),x, algorithm="fricas")
```

output
```
-1/12*(6*a*d^3*x^2*cos_integral(d*x)*sin(c) + 6*a*d^3*x^2*cos(c)*sin_integ
ral(d*x) - 2*(-I*a*d^3/b)^(1/3)*b*x^2*Ei(I*d*x + (-I*a*d^3/b)^(1/3))*e^(I*
c - (-I*a*d^3/b)^(1/3)) - 2*(I*a*d^3/b)^(1/3)*b*x^2*Ei(-I*d*x + (I*a*d^3/b
)^(1/3))*e^(-I*c - (I*a*d^3/b)^(1/3)) + 6*a*d^2*x*cos(d*x + c) - (-I*sqrt(
3)*b*x^2 - b*x^2)*(I*a*d^3/b)^(1/3)*Ei(-I*d*x + 1/2*(I*a*d^3/b)^(1/3)*(-I*
sqrt(3) - 1))*e^(1/2*(I*a*d^3/b)^(1/3)*(I*sqrt(3) + 1) - I*c) - (-I*sqrt(3
)*b*x^2 - b*x^2)*(-I*a*d^3/b)^(1/3)*Ei(I*d*x + 1/2*(-I*a*d^3/b)^(1/3)*(-I*
sqrt(3) - 1))*e^(1/2*(-I*a*d^3/b)^(1/3)*(I*sqrt(3) + 1) + I*c) - (I*sqrt(3
)*b*x^2 - b*x^2)*(I*a*d^3/b)^(1/3)*Ei(-I*d*x + 1/2*(I*a*d^3/b)^(1/3)*(I*sq
rt(3) - 1))*e^(1/2*(I*a*d^3/b)^(1/3)*(-I*sqrt(3) + 1) - I*c) - (I*sqrt(3)*
b*x^2 - b*x^2)*(-I*a*d^3/b)^(1/3)*Ei(I*d*x + 1/2*(-I*a*d^3/b)^(1/3)*(I*sqr
t(3) - 1))*e^(1/2*(-I*a*d^3/b)^(1/3)*(-I*sqrt(3) + 1) + I*c) + 6*a*d*sin(d
*x + c))/(a^2*d*x^2)
```

### 3.101.6 Sympy [F]

$$\int \frac{\sin(c+dx)}{x^3(a+bx^3)}\,dx = \int \frac{\sin(c+dx)}{x^3(a+bx^3)}\,dx$$

input
```
integrate(sin(d*x+c)/x**3/(b*x**3+a),x)
```

output
```
Integral(sin(c + d*x)/(x**3*(a + b*x**3)), x)
```

### 3.101.7 Maxima [F]

$$\int \frac{\sin(c+dx)}{x^3(a+bx^3)}\,dx = \int \frac{\sin(dx+c)}{(bx^3+a)x^3}\,dx$$

input
```
integrate(sin(d*x+c)/x^3/(b*x^3+a),x, algorithm="maxima")
```

output
```
integrate(sin(d*x + c)/((b*x^3 + a)*x^3), x)
```

### 3.101.8 Giac [F]

$$\int \frac{\sin(c+dx)}{x^3(a+bx^3)}\,dx = \int \frac{\sin(dx+c)}{(bx^3+a)x^3}\,dx$$

input
```
integrate(sin(d*x+c)/x^3/(b*x^3+a),x, algorithm="giac")
```

output
```
integrate(sin(d*x + c)/((b*x^3 + a)*x^3), x)
```

### 3.101.9 Mupad [F(-1)]

Timed out.

$$\int \frac{\sin(c+dx)}{x^3(a+bx^3)}\,dx = \int \frac{\sin(c+d\,x)}{x^3\,(b\,x^3+a)}\,dx$$

input
```
int(sin(c + d*x)/(x^3*(a + b*x^3)),x)
```

output
```
int(sin(c + d*x)/(x^3*(a + b*x^3)), x)
```

# 3.102 $\int \frac{x^3 \sin(c+dx)}{(a+bx^3)^2} \, dx$

### 3.102.1 Optimal result

Integrand size = 19, antiderivative size = 714

$$
\begin{aligned}
\int \frac{x^3 \sin(c+dx)}{(a+bx^3)^2}\,dx = &-\frac{(-1)^{2/3} d \cos\left(c+\frac{\sqrt[3]{-1}\sqrt[3]{a}d}{\sqrt[3]{b}}\right) \operatorname{CosIntegral}\left(\frac{\sqrt[3]{-1}\sqrt[3]{a}d}{\sqrt[3]{b}}-dx\right)}{9\sqrt[3]{a}b^{5/3}} \\
&-\frac{d \cos\left(c-\frac{\sqrt[3]{a}d}{\sqrt[3]{b}}\right) \operatorname{CosIntegral}\left(\frac{\sqrt[3]{a}d}{\sqrt[3]{b}}+dx\right)}{9\sqrt[3]{a}b^{5/3}} \\
&+\frac{\sqrt[3]{-1} d \cos\left(c-\frac{(-1)^{2/3}\sqrt[3]{a}d}{\sqrt[3]{b}}\right) \operatorname{CosIntegral}\left(\frac{(-1)^{2/3}\sqrt[3]{a}d}{\sqrt[3]{b}}+dx\right)}{9\sqrt[3]{a}b^{5/3}} \\
&+\frac{\operatorname{CosIntegral}\left(\frac{\sqrt[3]{a}d}{\sqrt[3]{b}}+dx\right) \sin\left(c-\frac{\sqrt[3]{a}d}{\sqrt[3]{b}}\right)}{9a^{2/3}b^{4/3}} \\
&-\frac{\sqrt[3]{-1} \operatorname{CosIntegral}\left(\frac{\sqrt[3]{-1}\sqrt[3]{a}d}{\sqrt[3]{b}}-dx\right) \sin\left(c+\frac{\sqrt[3]{-1}\sqrt[3]{a}d}{\sqrt[3]{b}}\right)}{9a^{2/3}b^{4/3}} \\
&+\frac{(-1)^{2/3} \operatorname{CosIntegral}\left(\frac{(-1)^{2/3}\sqrt[3]{a}d}{\sqrt[3]{b}}+dx\right) \sin\left(c-\frac{(-1)^{2/3}\sqrt[3]{a}d}{\sqrt[3]{b}}\right)}{9a^{2/3}b^{4/3}} \\
&-\frac{x\sin(c+dx)}{3b(a+bx^3)}+\frac{\sqrt[3]{-1} \cos\left(c+\frac{\sqrt[3]{-1}\sqrt[3]{a}d}{\sqrt[3]{b}}\right) \operatorname{Si}\left(\frac{\sqrt[3]{-1}\sqrt[3]{a}d}{\sqrt[3]{b}}-dx\right)}{9a^{2/3}b^{4/3}} \\
&-\frac{(-1)^{2/3} d \sin\left(c+\frac{\sqrt[3]{-1}\sqrt[3]{a}d}{\sqrt[3]{b}}\right) \operatorname{Si}\left(\frac{\sqrt[3]{-1}\sqrt[3]{a}d}{\sqrt[3]{b}}-dx\right)}{9\sqrt[3]{a}b^{5/3}} \\
&+\frac{\cos\left(c-\frac{\sqrt[3]{a}d}{\sqrt[3]{b}}\right) \operatorname{Si}\left(\frac{\sqrt[3]{a}d}{\sqrt[3]{b}}+dx\right)}{9a^{2/3}b^{4/3}} \\
&+\frac{d \sin\left(c-\frac{\sqrt[3]{a}d}{\sqrt[3]{b}}\right) \operatorname{Si}\left(\frac{\sqrt[3]{a}d}{\sqrt[3]{b}}+dx\right)}{9\sqrt[3]{a}b^{5/3}} \\
&+\frac{(-1)^{2/3} \cos\left(c-\frac{(-1)^{2/3}\sqrt[3]{a}d}{\sqrt[3]{b}}\right) \operatorname{Si}\left(\frac{(-1)^{2/3}\sqrt[3]{a}d}{\sqrt[3]{b}}+dx\right)}{9a^{2/3}b^{4/3}} \\
&-\frac{\sqrt[3]{-1} d \sin\left(c-\frac{(-1)^{2/3}\sqrt[3]{a}d}{\sqrt[3]{b}}\right) \operatorname{Si}\left(\frac{(-1)^{2/3}\sqrt[3]{a}d}{\sqrt[3]{b}}+dx\right)}{9\sqrt[3]{a}b^{5/3}}
\end{aligned}
$$

output
```
-1/9*d*Ci(a^(1/3)*d/b^(1/3)+d*x)*cos(c-a^(1/3)*d/b^(1/3))/a^(1/3)/b^(5/3)-
1/9*(-1)^(2/3)*d*Ci((-1)^(1/3)*a^(1/3)*d/b^(1/3)-d*x)*cos(c+(-1)^(1/3)*a^(
1/3)*d/b^(1/3))/a^(1/3)/b^(5/3)+1/9*(-1)^(1/3)*d*Ci((-1)^(2/3)*a^(1/3)*d/b
^(1/3)+d*x)*cos(c-(-1)^(2/3)*a^(1/3)*d/b^(1/3))/a^(1/3)/b^(5/3)-1/9*(-1)^(
1/3)*cos(c+(-1)^(1/3)*a^(1/3)*d/b^(1/3))*Si(-(-1)^(1/3)*a^(1/3)*d/b^(1/3)+
d*x)/a^(2/3)/b^(4/3)+1/9*cos(c-a^(1/3)*d/b^(1/3))*Si(a^(1/3)*d/b^(1/3)+d*x
)/a^(2/3)/b^(4/3)+1/9*(-1)^(2/3)*cos(c-(-1)^(2/3)*a^(1/3)*d/b^(1/3))*Si((-
1)^(2/3)*a^(1/3)*d/b^(1/3)+d*x)/a^(2/3)/b^(4/3)+1/9*Ci(a^(1/3)*d/b^(1/3)+d
*x)*sin(c-a^(1/3)*d/b^(1/3))/a^(2/3)/b^(4/3)+1/9*d*Si(a^(1/3)*d/b^(1/3)+d*
x)*sin(c-a^(1/3)*d/b^(1/3))/a^(1/3)/b^(5/3)-1/9*(-1)^(1/3)*Ci((-1)^(1/3)*a
^(1/3)*d/b^(1/3)-d*x)*sin(c+(-1)^(1/3)*a^(1/3)*d/b^(1/3))/a^(2/3)/b^(4/3)+
1/9*(-1)^(2/3)*d*Si(-(-1)^(1/3)*a^(1/3)*d/b^(1/3)+d*x)*sin(c+(-1)^(1/3)*a^
(1/3)*d/b^(1/3))/a^(1/3)/b^(5/3)+1/9*(-1)^(2/3)*Ci((-1)^(2/3)*a^(1/3)*d/b^
(1/3)+d*x)*sin(c-(-1)^(2/3)*a^(1/3)*d/b^(1/3))/a^(2/3)/b^(4/3)-1/9*(-1)^(1
/3)*d*Si((-1)^(2/3)*a^(1/3)*d/b^(1/3)+d*x)*sin(c-(-1)^(2/3)*a^(1/3)*d/b^(1
/3))/a^(1/3)/b^(5/3)-1/3*x*sin(d*x+c)/b/(b*x^3+a)
```

### 3.102.2 Mathematica [C] (verified)

Result contains higher order function than in optimal. Order 9 vs. order 4 in optimal.

Time = 0.17 (sec) , antiderivative size = 383, normalized size of antiderivative = 0.54

$$\int \frac{x^3\sin(c+dx)}{(a+bx^3)^2}\,dx$$

$$= \frac{\text{RootSum}\left[a+b\#1^3\&,\frac{i\cos(c+d\#1)\,\text{CosIntegral}(d(x-\#1))+\text{CosIntegral}(d(x-\#1))\sin(c+d\#1)+\cos(c+d\#1)\text{Si}(d(x-\#1))-i\,s}{}\right.}{}$$

input
```
Integrate[(x^3*Sin[c + d*x])/(a + b*x^3)^2,x]
```

output
```
(RootSum[a + b*#1^3 & , (I*Cos[c + d*#1]*CosIntegral[d*(x - #1)] + CosInte
gral[d*(x - #1)]*Sin[c + d*#1] + Cos[c + d*#1]*SinIntegral[d*(x - #1)] - I
*Sin[c + d*#1]*SinIntegral[d*(x - #1)] + d*Cos[c + d*#1]*CosIntegral[d*(x
- #1)]*#1 - I*d*CosIntegral[d*(x - #1)]*Sin[c + d*#1]*#1 - I*d*Cos[c + d*#
1]*SinIntegral[d*(x - #1)]*#1 - d*Sin[c + d*#1]*SinIntegral[d*(x - #1)]*#1
)/#1^2 & ] + RootSum[a + b*#1^3 & , ((-I)*Cos[c + d*#1]*CosIntegral[d*(x -
 #1)] + CosIntegral[d*(x - #1)]*Sin[c + d*#1] + Cos[c + d*#1]*SinIntegral[
d*(x - #1)] + I*Sin[c + d*#1]*SinIntegral[d*(x - #1)] + d*Cos[c + d*#1]*Co
sIntegral[d*(x - #1)]*#1 + I*d*CosIntegral[d*(x - #1)]*Sin[c + d*#1]*#1 +
I*d*Cos[c + d*#1]*SinIntegral[d*(x - #1)]*#1 - d*Sin[c + d*#1]*SinIntegral
[d*(x - #1)]*#1)/#1^2 & ] - (6*b*x*Sin[c + d*x])/(a + b*x^3))/(18*b^2)
```

## 3.102.3 Rubi [A] (verified)

Time = 1.51 (sec) , antiderivative size = 725, normalized size of antiderivative = 1.02, number of steps used = 5, number of rules used = 5, $\frac{\text{number of rules}}{\text{integrand size}} = 0.263$, Rules used = {3824, 3814, 2009, 3827, 2009}

Below are the steps used by Rubi to obtain the solution. The rule number used for the transformation is given above next to the arrow. The rules definitions used are listed below.

$$\int \frac{x^3\sin(c+dx)}{(a+bx^3)^2}dx$$

$$\Big\downarrow \text{3824}$$

$$\frac{\int \frac{\sin(c+dx)}{bx^3+a}dx}{3b}+\frac{d\int \frac{x\cos(c+dx)}{bx^3+a}dx}{3b}-\frac{x\sin(c+dx)}{3b(a+bx^3)}$$

$$\Big\downarrow \text{3814}$$

$$\frac{\int \left(-\frac{\sin(c+dx)}{3a^{2/3}\left(-\sqrt[3]{b}x-\sqrt[3]{a}\right)}-\frac{\sin(c+dx)}{3a^{2/3}\left(\sqrt[3]{-1}\sqrt[3]{b}x-\sqrt[3]{a}\right)}-\frac{\sin(c+dx)}{3a^{2/3}\left(-(-1)^{2/3}\sqrt[3]{b}x-\sqrt[3]{a}\right)}\right)dx}{3b}+$$
$$\frac{d\int \frac{x\cos(c+dx)}{bx^3+a}dx}{3b}-\frac{x\sin(c+dx)}{3b(a+bx^3)}$$

$$\Big\downarrow \text{2009}$$

$$\frac{d\int \frac{x\cos(c+dx)}{bx^3+a}dx}{3b}+$$

$$\frac{\frac{\sin\left(c-\frac{\sqrt[3]{a}d}{\sqrt[3]{b}}\right)\text{CosIntegral}\left(xd+\frac{\sqrt[3]{a}d}{\sqrt[3]{b}}\right)}{3a^{2/3}\sqrt[3]{b}}-\frac{\sqrt[3]{-1}\sin\left(\frac{\sqrt[3]{-1}\sqrt[3]{a}d}{\sqrt[3]{b}}+c\right)\text{CosIntegral}\left(\frac{\sqrt[3]{-1}\sqrt[3]{a}d}{\sqrt[3]{b}}-dx\right)}{3a^{2/3}\sqrt[3]{b}}+\frac{(-1)^{2/3}\sin\left(c-\frac{(-1)^{2/3}\sqrt[3]{a}d}{\sqrt[3]{b}}\right)\cdots}{3a^{2}\cdots}}{\cdots}$$

$$\frac{x\sin(c+dx)}{3b\left(a+bx^3\right)}$$

$\downarrow$ 3827

$$\frac{d\int\left(-\frac{\cos(c+dx)}{3\sqrt[3]{a}\sqrt[3]{b}\left(\sqrt[3]{b}x+\sqrt[3]{a}\right)}-\frac{(-1)^{2/3}\cos(c+dx)}{3\sqrt[3]{a}\sqrt[3]{b}\left(\sqrt[3]{a}-\sqrt[3]{-1}\sqrt[3]{b}x\right)}+\frac{\sqrt[3]{-1}\cos(c+dx)}{3\sqrt[3]{a}\sqrt[3]{b}\left((-1)^{2/3}\sqrt[3]{b}x+\sqrt[3]{a}\right)}\right)dx}{3b}+$$

$$\frac{\frac{\sin\left(c-\frac{\sqrt[3]{a}d}{\sqrt[3]{b}}\right)\text{CosIntegral}\left(xd+\frac{\sqrt[3]{a}d}{\sqrt[3]{b}}\right)}{3a^{2/3}\sqrt[3]{b}}-\frac{\sqrt[3]{-1}\sin\left(\frac{\sqrt[3]{-1}\sqrt[3]{a}d}{\sqrt[3]{b}}+c\right)\text{CosIntegral}\left(\frac{\sqrt[3]{-1}\sqrt[3]{a}d}{\sqrt[3]{b}}-dx\right)}{3a^{2/3}\sqrt[3]{b}}+\frac{(-1)^{2/3}\sin\left(c-\frac{(-1)^{2/3}\sqrt[3]{a}d}{\sqrt[3]{b}}\right)\cdots}{3a^{2}\cdots}}{\cdots}$$

$$\frac{x\sin(c+dx)}{3b\left(a+bx^3\right)}$$

$\downarrow$ 2009

$$\frac{\frac{\sin\left(c-\frac{\sqrt[3]{a}d}{\sqrt[3]{b}}\right)\text{CosIntegral}\left(xd+\frac{\sqrt[3]{a}d}{\sqrt[3]{b}}\right)}{3a^{2/3}\sqrt[3]{b}}-\frac{\sqrt[3]{-1}\sin\left(\frac{\sqrt[3]{-1}\sqrt[3]{a}d}{\sqrt[3]{b}}+c\right)\text{CosIntegral}\left(\frac{\sqrt[3]{-1}\sqrt[3]{a}d}{\sqrt[3]{b}}-dx\right)}{3a^{2/3}\sqrt[3]{b}}+\frac{(-1)^{2/3}\sin\left(c-\frac{(-1)^{2/3}\sqrt[3]{a}d}{\sqrt[3]{b}}\right)\cdots}{3a^{2}\cdots}}{\cdots}$$

$$\frac{d\left(-\frac{(-1)^{2/3}\cos\left(\frac{\sqrt[3]{-1}\sqrt[3]{a}d}{\sqrt[3]{b}}+c\right)\text{CosIntegral}\left(\frac{\sqrt[3]{-1}\sqrt[3]{a}d}{\sqrt[3]{b}}-dx\right)}{3\sqrt[3]{a}b^{2/3}}-\frac{\cos\left(c-\frac{\sqrt[3]{a}d}{\sqrt[3]{b}}\right)\text{CosIntegral}\left(xd+\frac{\sqrt[3]{a}d}{\sqrt[3]{b}}\right)}{3\sqrt[3]{a}b^{2/3}}+\frac{\sqrt[3]{-1}\cos\left(c-\frac{(-1)^{2/3}\cdots}{\sqrt[3]{\cdots}}\right.\cdots}{\cdots}\right.\cdots}{\cdots}$$

$$\frac{x\sin(c+dx)}{3b\left(a+bx^3\right)}$$

input
```
Int[(x^3*Sin[c + d*x])/(a + b*x^3)^2,x]
```

3.102. $\int \frac{x^3\sin(c+dx)}{\left(a+bx^3\right)^2}\,dx$

output
```
-1/3*(x*Sin[c + d*x])/(b*(a + b*x^3)) + ((CosIntegral[(a^(1/3)*d)/b^(1/3)
+ d*x]*Sin[c - (a^(1/3)*d)/b^(1/3)])/(3*a^(2/3)*b^(1/3)) - ((-1)^(1/3)*Cos
Integral[((-1)^(1/3)*a^(1/3)*d)/b^(1/3) - d*x]*Sin[c + ((-1)^(1/3)*a^(1/3)
*d)/b^(1/3)])/(3*a^(2/3)*b^(1/3)) + ((-1)^(2/3)*CosIntegral[((-1)^(2/3)*a^
(1/3)*d)/b^(1/3) + d*x]*Sin[c - ((-1)^(2/3)*a^(1/3)*d)/b^(1/3)])/(3*a^(2/3
)*b^(1/3)) + ((-1)^(1/3)*Cos[c + ((-1)^(1/3)*a^(1/3)*d)/b^(1/3)]*SinIntegr
al[((-1)^(1/3)*a^(1/3)*d)/b^(1/3) - d*x])/(3*a^(2/3)*b^(1/3)) + (Cos[c - (
a^(1/3)*d)/b^(1/3)]*SinIntegral[(a^(1/3)*d)/b^(1/3) + d*x])/(3*a^(2/3)*b^(
1/3)) + ((-1)^(2/3)*Cos[c - ((-1)^(2/3)*a^(1/3)*d)/b^(1/3)]*SinIntegral[((
-1)^(2/3)*a^(1/3)*d)/b^(1/3) + d*x])/(3*a^(2/3)*b^(1/3)))/(3*b) + (d*(-1/3
*((-1)^(2/3)*Cos[c + ((-1)^(1/3)*a^(1/3)*d)/b^(1/3)]*CosIntegral[((-1)^(1/
3)*a^(1/3)*d)/b^(1/3) - d*x])/(a^(1/3)*b^(2/3)) - (Cos[c - (a^(1/3)*d)/b^(
1/3)]*CosIntegral[(a^(1/3)*d)/b^(1/3) + d*x])/(3*a^(1/3)*b^(2/3)) + ((-1)^
(1/3)*Cos[c - ((-1)^(2/3)*a^(1/3)*d)/b^(1/3)]*CosIntegral[((-1)^(2/3)*a^(1
/3)*d)/b^(1/3) + d*x])/(3*a^(1/3)*b^(2/3)) - ((-1)^(2/3)*Sin[c + ((-1)^(1/
3)*a^(1/3)*d)/b^(1/3)]*SinIntegral[((-1)^(1/3)*a^(1/3)*d)/b^(1/3) - d*x])/
(3*a^(1/3)*b^(2/3)) + (Sin[c - (a^(1/3)*d)/b^(1/3)]*SinIntegral[(a^(1/3)*d
)/b^(1/3) + d*x])/(3*a^(1/3)*b^(2/3)) - ((-1)^(1/3)*Sin[c - ((-1)^(2/3)*a^
(1/3)*d)/b^(1/3)]*SinIntegral[((-1)^(2/3)*a^(1/3)*d)/b^(1/3) + d*x])/(3*a^
(1/3)*b^(2/3))))/(3*b)
```

### 3.102.3.1 Defintions of rubi rules used

rule 2009
```
Int[u_, x_Symbol] :> Simp[IntSum[u, x], x] /; SumQ[u]
```

rule 3814
```
Int[((a_) + (b_.)*(x_)^(n_))^(p_)*Sin[(c_.) + (d_.)*(x_)], x_Symbol] :> Int
[ExpandIntegrand[Sin[c + d*x], (a + b*x^n)^p, x], x] /; FreeQ[{a, b, c, d},
 x] && ILtQ[p, 0] && IGtQ[n, 0] && (EqQ[n, 2] || EqQ[p, -1])
```

rule 3824
```
Int[(x_)^(m_.)*((a_) + (b_.)*(x_)^(n_))^(p_)*Sin[(c_.) + (d_.)*(x_)], x_Sym
bol] :> Simp[x^(m - n + 1)*(a + b*x^n)^(p + 1)*(Sin[c + d*x]/(b*n*(p + 1)))
, x] + (-Simp[(m - n + 1)/(b*n*(p + 1))   Int[x^(m - n)*(a + b*x^n)^(p + 1)
*Sin[c + d*x], x], x] - Simp[d/(b*n*(p + 1))   Int[x^(m - n + 1)*(a + b*x^n
)^(p + 1)*Cos[c + d*x], x], x]) /; FreeQ[{a, b, c, d, m}, x] && ILtQ[p, -1]
 && IGtQ[n, 0] && (GtQ[m - n + 1, 0] || GtQ[n, 2]) && RationalQ[m]
```

## 3.102. $\int \frac{x^3 \sin(c+dx)}{(a+bx^3)^2} \, dx$

rule 3827
```
Int[Cos[(c_.) + (d_.)*(x_)]*(x_)^(m_.)*((a_) + (b_.)*(x_)^(n_))^(p_), x_Sym
bol] :> Int[ExpandIntegrand[Cos[c + d*x], x^m*(a + b*x^n)^p, x], x] /; Free
Q[{a, b, c, d, m}, x] && ILtQ[p, 0] && IGtQ[n, 0] && (EqQ[n, 2] || EqQ[p, -
1]) && IntegerQ[m]
```

### 3.102.4 Maple [C] (verified)

Result contains higher order function than in optimal. Order 9 vs. order 4.

Time = 0.93 (sec) , antiderivative size = 1184, normalized size of antiderivative = 1.66

| method | result | size |
|---|---|---|
| derivativedivides | Expression too large to display | 1184 |
| default | Expression too large to display | 1184 |
| risch | Expression too large to display | 1379 |

input
```
int(x^3*sin(d*x+c)/(b*x^3+a)^2,x,method=_RETURNVERBOSE)
```

output
```
1/d^4*(-d^6*c^3*(sin(d*x+c)*(1/3/a/d^3*(d*x+c)-1/3*c/a/d^3)/(a*d^3-c^3*b+3
*b*c^2*(d*x+c)-3*b*c*(d*x+c)^2+b*(d*x+c)^3)+2/9/a/d^3/b*sum(1/(_R1^2-2*_R1
*c+c^2)*(-Si(-d*x+_R1-c)*cos(_R1)+Ci(d*x-_R1+c)*sin(_R1)),_R1=RootOf(_Z^3*
b-3*_Z^2*b*c+3*_Z*b*c^2+a*d^3-b*c^3))+1/9/a/d^3/b*sum(1/(-_RR1+c)*(Si(-d*x
+_RR1-c)*sin(_RR1)+Ci(d*x-_RR1+c)*cos(_RR1)),_RR1=RootOf(_Z^3*b-3*_Z^2*b*c
+3*_Z*b*c^2+a*d^3-b*c^3)))+sin(d*x+c)*(c^2*d^3/a*(d*x+c)^2-c^3*d^3/a*(d*x+
c))/(a*d^3-c^3*b+3*b*c^2*(d*x+c)-3*b*c*(d*x+c)^2+b*(d*x+c)^3)+1/3*c^2*d^3/
a/b*sum((c+_R1)/(_R1^2-2*_R1*c+c^2)*(-Si(-d*x+_R1-c)*cos(_R1)+Ci(d*x-_R1+c
)*sin(_R1)),_R1=RootOf(_Z^3*b-3*_Z^2*b*c+3*_Z*b*c^2+a*d^3-b*c^3))+1/3*c^2*
d^3/a/b*sum(_RR1/(-_RR1+c)*(Si(-d*x+_RR1-c)*sin(_RR1)+Ci(d*x-_RR1+c)*cos(_
RR1)),_RR1=RootOf(_Z^3*b-3*_Z^2*b*c+3*_Z*b*c^2+a*d^3-b*c^3))+sin(d*x+c)*(-
2*c^2*d^3/a*(d*x+c)^2+3*c^3*d^3/a*(d*x+c)+c*d^3*(a*d^3-b*c^3)/a/b)/(a*d^3-
c^3*b+3*b*c^2*(d*x+c)-3*b*c*(d*x+c)^2+b*(d*x+c)^3)-2/3*c^2*d^3/a/b*sum(_R1
/(_R1^2-2*_R1*c+c^2)*(-Si(-d*x+_R1-c)*cos(_R1)+Ci(d*x-_R1+c)*sin(_R1)),_R1
=RootOf(_Z^3*b-3*_Z^2*b*c+3*_Z*b*c^2+a*d^3-b*c^3))-1/3*c*d^3/a/b^2*sum((-2
*_RR1^2*b*c+3*_RR1*b*c^2+a*d^3-b*c^3)/(_RR1^2-2*_RR1*c+c^2)*(Si(-d*x+_RR1-
c)*sin(_RR1)+Ci(d*x-_RR1+c)*cos(_RR1)),_RR1=RootOf(_Z^3*b-3*_Z^2*b*c+3*_Z*
b*c^2+a*d^3-b*c^3))+sin(d*x+c)*(c^2*d^3/a*(d*x+c)^2-1/3*d^3*(a*d^3+5*b*c^3
)/a/b*(d*x+c)-2/3*c*d^3*(a*d^3-b*c^3)/a/b)/(a*d^3-c^3*b+3*b*c^2*(d*x+c)-3*
b*c*(d*x+c)^2+b*(d*x+c)^3)+1/9*d^3/a/b^2*sum((3*_R1*b*c^2+a*d^3-b*c^3)/...
```

### 3.102.5 Fricas [C] (verification not implemented)

Result contains complex when optimal does not.

Time = 0.30 (sec) , antiderivative size = 670, normalized size of antiderivative = 0.94

$$\int \frac{x^3 \sin(c+dx)}{(a+bx^3)^2}\,dx =$$

$$-\frac{12\,adx\sin(dx+c)+\left(\left(bx^3-\sqrt{3}(i\,bx^3+i\,a)+a\right)\left(\frac{i\,ad^3}{b}\right)^{\frac{2}{3}}-\left(bx^3+\sqrt{3}(i\,bx^3+i\,a)+a\right)\left(\frac{i\,ad^3}{b}\right)^{\frac{1}{3}}\right)\mathrm{Ei}\left(\right.}{}$$

input
```
integrate(x^3*sin(d*x+c)/(b*x^3+a)^2,x, algorithm="fricas")
```

output
```
-1/36*(12*a*d*x*sin(d*x + c) + ((b*x^3 - sqrt(3)*(I*b*x^3 + I*a) + a)*(I*a
*d^3/b)^(2/3) - (b*x^3 + sqrt(3)*(I*b*x^3 + I*a) + a)*(I*a*d^3/b)^(1/3))*E
i(-I*d*x + 1/2*(I*a*d^3/b)^(1/3)*(-I*sqrt(3) - 1))*e^(1/2*(I*a*d^3/b)^(1/3
)*(I*sqrt(3) + 1) - I*c) + ((b*x^3 - sqrt(3)*(I*b*x^3 + I*a) + a)*(-I*a*d^
3/b)^(2/3) - (b*x^3 + sqrt(3)*(I*b*x^3 + I*a) + a)*(-I*a*d^3/b)^(1/3))*Ei(
I*d*x + 1/2*(-I*a*d^3/b)^(1/3)*(-I*sqrt(3) - 1))*e^(1/2*(-I*a*d^3/b)^(1/3)
*(I*sqrt(3) + 1) + I*c) + ((b*x^3 - sqrt(3)*(-I*b*x^3 - I*a) + a)*(I*a*d^3
/b)^(2/3) - (b*x^3 + sqrt(3)*(-I*b*x^3 - I*a) + a)*(I*a*d^3/b)^(1/3))*Ei(-
I*d*x + 1/2*(I*a*d^3/b)^(1/3)*(I*sqrt(3) - 1))*e^(1/2*(I*a*d^3/b)^(1/3)*(-
I*sqrt(3) + 1) - I*c) + ((b*x^3 - sqrt(3)*(-I*b*x^3 - I*a) + a)*(-I*a*d^3/
b)^(2/3) - (b*x^3 + sqrt(3)*(-I*b*x^3 - I*a) + a)*(-I*a*d^3/b)^(1/3))*Ei(I
*d*x + 1/2*(-I*a*d^3/b)^(1/3)*(I*sqrt(3) - 1))*e^(1/2*(-I*a*d^3/b)^(1/3)*(
-I*sqrt(3) + 1) + I*c) - 2*((b*x^3 + a)*(-I*a*d^3/b)^(2/3) - (b*x^3 + a)*(
-I*a*d^3/b)^(1/3))*Ei(I*d*x + (-I*a*d^3/b)^(1/3))*e^(I*c - (-I*a*d^3/b)^(1
/3)) - 2*((b*x^3 + a)*(I*a*d^3/b)^(2/3) - (b*x^3 + a)*(I*a*d^3/b)^(1/3))*E
i(-I*d*x + (I*a*d^3/b)^(1/3))*e^(-I*c - (I*a*d^3/b)^(1/3)))/(a*b^2*d*x^3 +
 a^2*b*d)
```

### 3.102.6 Sympy [F(-1)]

Timed out.

$$\int \frac{x^3 \sin(c+dx)}{(a+bx^3)^2}\,dx = \text{Timed out}$$

input
```
integrate(x**3*sin(d*x+c)/(b*x**3+a)**2,x)
```

output
```
Timed out
```

### 3.102.7 Maxima [F]

$$\int \frac{x^3 \sin(c+dx)}{(a+bx^3)^2} dx = \int \frac{x^3 \sin(dx+c)}{(bx^3+a)^2} dx$$

input
```
integrate(x^3*sin(d*x+c)/(b*x^3+a)^2,x, algorithm="maxima")
```

output
```
-1/2*(3*(cos(c)^2 + sin(c)^2)*d*x^2*sin(d*x + c) + ((d^2*x^3*cos(c) - 3*d*
x^2*sin(c) - 12*x*cos(c))*cos(d*x + c)^2 + (d^2*x^3*cos(c) - 3*d*x^2*sin(c
) - 12*x*cos(c))*sin(d*x + c)^2)*cos(d*x + 2*c) + ((cos(c)^2 + sin(c)^2)*d
^2*x^3 - 12*(cos(c)^2 + sin(c)^2)*x)*cos(d*x + c) - 2*(((b^2*cos(c)^2 + b^
2*sin(c)^2)*d^3*x^6 + 2*(a*b*cos(c)^2 + a*b*sin(c)^2)*d^3*x^3 + (a^2*cos(c
)^2 + a^2*sin(c)^2)*d^3)*cos(d*x + c)^2 + ((b^2*cos(c)^2 + b^2*sin(c)^2)*d
^3*x^6 + 2*(a*b*cos(c)^2 + a*b*sin(c)^2)*d^3*x^3 + (a^2*cos(c)^2 + a^2*sin
(c)^2)*d^3)*sin(d*x + c)^2)*integrate(3*(3*a*d*x*sin(d*x + c) + (a*d^2*x^2
 + 10*b*x^3 - 2*a)*cos(d*x + c))/(b^3*d^3*x^9 + 3*a*b^2*d^3*x^6 + 3*a^2*b*
d^3*x^3 + a^3*d^3), x) - 2*(((b^2*cos(c)^2 + b^2*sin(c)^2)*d^3*x^6 + 2*(a*
b*cos(c)^2 + a*b*sin(c)^2)*d^3*x^3 + (a^2*cos(c)^2 + a^2*sin(c)^2)*d^3)*co
s(d*x + c)^2 + ((b^2*cos(c)^2 + b^2*sin(c)^2)*d^3*x^6 + 2*(a*b*cos(c)^2 +
a*b*sin(c)^2)*d^3*x^3 + (a^2*cos(c)^2 + a^2*sin(c)^2)*d^3)*sin(d*x + c)^2)
*integrate(3*(3*a*d*x*sin(d*x + c) + (a*d^2*x^2 + 10*b*x^3 - 2*a)*cos(d*x
+ c))/((b^3*d^3*x^9 + 3*a*b^2*d^3*x^6 + 3*a^2*b*d^3*x^3 + a^3*d^3)*cos(d*x
 + c)^2 + (b^3*d^3*x^9 + 3*a*b^2*d^3*x^6 + 3*a^2*b*d^3*x^3 + a^3*d^3)*sin(
d*x + c)^2), x) + ((d^2*x^3*sin(c) + 3*d*x^2*cos(c) - 12*x*sin(c))*cos(d*x
 + c)^2 + (d^2*x^3*sin(c) + 3*d*x^2*cos(c) - 12*x*sin(c))*sin(d*x + c)^2)*
sin(d*x + 2*c))/(((b^2*cos(c)^2 + b^2*sin(c)^2)*d^3*x^6 + 2*(a*b*cos(c)^2
+ a*b*sin(c)^2)*d^3*x^3 + (a^2*cos(c)^2 + a^2*sin(c)^2)*d^3)*cos(d*x + ...
```

### 3.102.8 Giac [F]

$$\int \frac{x^3 \sin(c+dx)}{(a+bx^3)^2}\, dx = \int \frac{x^3 \sin(dx+c)}{(bx^3+a)^2}\, dx$$

input
```
integrate(x^3*sin(d*x+c)/(b*x^3+a)^2,x, algorithm="giac")
```

output
```
integrate(x^3*sin(d*x + c)/(b*x^3 + a)^2, x)
```

### 3.102.9 Mupad [F(-1)]

Timed out.

$$\int \frac{x^3 \sin(c+dx)}{(a+bx^3)^2}\, dx = \int \frac{x^3 \sin(c+d\,x)}{(b\,x^3+a)^2}\, dx$$

input
```
int((x^3*sin(c + d*x))/(a + b*x^3)^2,x)
```

output
```
int((x^3*sin(c + d*x))/(a + b*x^3)^2, x)
```

# 3.103 $\int \frac{x^2 \sin(c+dx)}{(a+bx^3)^2}\,dx$



## 3.103.1 Optimal result

Integrand size = 19, antiderivative size = 371

$$\begin{aligned}\int \frac{x^2\sin(c+dx)}{(a+bx^3)^2}\,dx =& -\frac{\sqrt[3]{-1}d\cos\left(c+\frac{\sqrt[3]{-1}\sqrt[3]{a}d}{\sqrt[3]{b}}\right)\text{CosIntegral}\left(\frac{\sqrt[3]{-1}\sqrt[3]{a}d}{\sqrt[3]{b}}-dx\right)}{9a^{2/3}b^{4/3}} \\ &+\frac{d\cos\left(c-\frac{\sqrt[3]{a}d}{\sqrt[3]{b}}\right)\text{CosIntegral}\left(\frac{\sqrt[3]{a}d}{\sqrt[3]{b}}+dx\right)}{9a^{2/3}b^{4/3}} \\ &+\frac{(-1)^{2/3}d\cos\left(c-\frac{(-1)^{2/3}\sqrt[3]{a}d}{\sqrt[3]{b}}\right)\text{CosIntegral}\left(\frac{(-1)^{2/3}\sqrt[3]{a}d}{\sqrt[3]{b}}+dx\right)}{9a^{2/3}b^{4/3}} \\ &-\frac{\sin(c+dx)}{3b(a+bx^3)}-\frac{\sqrt[3]{-1}d\sin\left(c+\frac{\sqrt[3]{-1}\sqrt[3]{a}d}{\sqrt[3]{b}}\right)\text{Si}\left(\frac{\sqrt[3]{-1}\sqrt[3]{a}d}{\sqrt[3]{b}}-dx\right)}{9a^{2/3}b^{4/3}} \\ &-\frac{d\sin\left(c-\frac{\sqrt[3]{a}d}{\sqrt[3]{b}}\right)\text{Si}\left(\frac{\sqrt[3]{a}d}{\sqrt[3]{b}}+dx\right)}{9a^{2/3}b^{4/3}} \\ &-\frac{(-1)^{2/3}d\sin\left(c-\frac{(-1)^{2/3}\sqrt[3]{a}d}{\sqrt[3]{b}}\right)\text{Si}\left(\frac{(-1)^{2/3}\sqrt[3]{a}d}{\sqrt[3]{b}}+dx\right)}{9a^{2/3}b^{4/3}}\end{aligned}$$

output
```
1/9*d*Ci(a^(1/3)*d/b^(1/3)+d*x)*cos(c-a^(1/3)*d/b^(1/3))/a^(2/3)/b^(4/3)-1
/9*(-1)^(1/3)*d*Ci((-1)^(1/3)*a^(1/3)*d/b^(1/3)-d*x)*cos(c+(-1)^(1/3)*a^(1
/3)*d/b^(1/3))/a^(2/3)/b^(4/3)+1/9*(-1)^(2/3)*d*Ci((-1)^(2/3)*a^(1/3)*d/b^
(1/3)+d*x)*cos(c-(-1)^(2/3)*a^(1/3)*d/b^(1/3))/a^(2/3)/b^(4/3)-1/9*d*Si(a^
(1/3)*d/b^(1/3)+d*x)*sin(c-a^(1/3)*d/b^(1/3))/a^(2/3)/b^(4/3)+1/9*(-1)^(1/
3)*d*Si(-(-1)^(1/3)*a^(1/3)*d/b^(1/3)+d*x)*sin(c+(-1)^(1/3)*a^(1/3)*d/b^(1
/3))/a^(2/3)/b^(4/3)-1/9*(-1)^(2/3)*d*Si((-1)^(2/3)*a^(1/3)*d/b^(1/3)+d*x)
*sin(c-(-1)^(2/3)*a^(1/3)*d/b^(1/3))/a^(2/3)/b^(4/3)-1/3*sin(d*x+c)/b/(b*x
^3+a)
```

### 3.103.2 Mathematica [C] (verified)

Result contains higher order function than in optimal. Order 9 vs. order 4 in optimal.

Time = 0.13 (sec) , antiderivative size = 214, normalized size of antiderivative = 0.58

$$\int \frac{x^2 \sin(c+dx)}{(a+bx^3)^2}\,dx$$
$$= \frac{d\text{RootSum}\left[a+b\#1^3\&, \frac{\cos(c+d\#1)\,\text{CosIntegral}(d(x-\#1))-i\,\text{CosIntegral}(d(x-\#1))\sin(c+d\#1)-i\cos(c+d\#1)\text{Si}(d(x-\#1))-}{\#1^2}\right.}{}$$

input
```
Integrate[(x^2*Sin[c + d*x])/(a + b*x^3)^2,x]
```

output
```
(d*RootSum[a + b*#1^3 & , (Cos[c + d*#1]*CosIntegral[d*(x - #1)] - I*CosIn
tegral[d*(x - #1)]*Sin[c + d*#1] - I*Cos[c + d*#1]*SinIntegral[d*(x - #1)]
 - Sin[c + d*#1]*SinIntegral[d*(x - #1)])/#1^2 & ] + d*RootSum[a + b*#1^3
& , (Cos[c + d*#1]*CosIntegral[d*(x - #1)] + I*CosIntegral[d*(x - #1)]*Sin
[c + d*#1] + I*Cos[c + d*#1]*SinIntegral[d*(x - #1)] - Sin[c + d*#1]*SinIn
tegral[d*(x - #1)])/#1^2 & ] - (6*b*Sin[c + d*x])/(a + b*x^3))/(18*b^2)
```

### 3.103.3 Rubi [A] (verified)

Time = 0.81 (sec) , antiderivative size = 374, normalized size of antiderivative = 1.01, number of steps used = 3, number of rules used = 3, $\frac{\text{number of rules}}{\text{integrand size}} = 0.158$, Rules used = {3822, 3815, 2009}

Below are the steps used by Rubi to obtain the solution. The rule number used for the transformation is given above next to the arrow. The rules definitions used are listed below.

$$\int \frac{x^2 \sin(c+dx)}{(a+bx^3)^2} \, dx$$

$$\Big\downarrow \; 3822$$

$$\frac{d\int \frac{\cos(c+dx)}{bx^3+a}dx}{3b} - \frac{\sin(c+dx)}{3b(a+bx^3)}$$

$$\Big\downarrow \; 3815$$

$$\frac{d\int \left(-\frac{\cos(c+dx)}{3a^{2/3}\left(-\sqrt[3]{b}x-\sqrt[3]{a}\right)}-\frac{\cos(c+dx)}{3a^{2/3}\left(\sqrt[3]{-1}\sqrt[3]{b}x-\sqrt[3]{a}\right)}-\frac{\cos(c+dx)}{3a^{2/3}\left(-(-1)^{2/3}\sqrt[3]{b}x-\sqrt[3]{a}\right)}\right)dx}{3b} - \frac{\sin(c+dx)}{3b(a+bx^3)}$$

$$\Big\downarrow \; 2009$$

$$\frac{d\left(-\frac{\sqrt[3]{-1}\cos\left(\frac{\sqrt[3]{-1}\sqrt[3]{a}d}{\sqrt[3]{b}}+c\right)\text{CosIntegral}\left(\frac{\sqrt[3]{-1}\sqrt[3]{a}d}{\sqrt[3]{b}}-dx\right)}{3a^{2/3}\sqrt[3]{b}}+\frac{\cos\left(c-\frac{\sqrt[3]{a}d}{\sqrt[3]{b}}\right)\text{CosIntegral}\left(xd+\frac{\sqrt[3]{a}d}{\sqrt[3]{b}}\right)}{3a^{2/3}\sqrt[3]{b}}+\frac{(-1)^{2/3}\cos\left(c-\frac{(-1)^{2/3}}{\sqrt[3]{\ }}\right.}{}\right.}{}$$

$$\frac{\sin(c+dx)}{3b(a+bx^3)}$$

input
```
Int[(x^2*Sin[c + d*x])/(a + b*x^3)^2,x]
```

output
```
-1/3*Sin[c + d*x]/(b*(a + b*x^3)) + (d*(-1/3*((-1)^(1/3)*Cos[c + ((-1)^(1/
3)*a^(1/3)*d)/b^(1/3)]*CosIntegral[((-1)^(1/3)*a^(1/3)*d)/b^(1/3) - d*x])/
(a^(2/3)*b^(1/3)) + (Cos[c - (a^(1/3)*d)/b^(1/3)]*CosIntegral[(a^(1/3)*d)/
b^(1/3) + d*x])/(3*a^(2/3)*b^(1/3)) + ((-1)^(2/3)*Cos[c - ((-1)^(2/3)*a^(1
/3)*d)/b^(1/3)]*CosIntegral[((-1)^(2/3)*a^(1/3)*d)/b^(1/3) + d*x])/(3*a^(2
/3)*b^(1/3)) - ((-1)^(1/3)*Sin[c + ((-1)^(1/3)*a^(1/3)*d)/b^(1/3)]*SinInte
gral[((-1)^(1/3)*a^(1/3)*d)/b^(1/3) - d*x])/(3*a^(2/3)*b^(1/3)) - (Sin[c -
 (a^(1/3)*d)/b^(1/3)]*SinIntegral[(a^(1/3)*d)/b^(1/3) + d*x])/(3*a^(2/3)*b
^(1/3)) - ((-1)^(2/3)*Sin[c - ((-1)^(2/3)*a^(1/3)*d)/b^(1/3)]*SinIntegral[
((-1)^(2/3)*a^(1/3)*d)/b^(1/3) + d*x])/(3*a^(2/3)*b^(1/3))))/(3*b)
```

## 3.103. $\int \frac{x^2 \sin(c+dx)}{(a+bx^3)^2} \, dx$

### 3.103.3.1 Defintions of rubi rules used

rule 2009
```
Int[u_, x_Symbol] :> Simp[IntSum[u, x], x] /; SumQ[u]
```

rule 3815
```
Int[Cos[(c_.) + (d_.)*(x_)]*((a_) + (b_.)*(x_)^(n_))^(p_), x_Symbol] :> Int
[ExpandIntegrand[Cos[c + d*x], (a + b*x^n)^p, x], x] /; FreeQ[{a, b, c, d},
 x] && ILtQ[p, 0] && IGtQ[n, 0] && (EqQ[n, 2] || EqQ[p, -1])
```

rule 3822
```
Int[((e_.)*(x_))^(m_.)*((a_) + (b_.)*(x_)^(n_))^(p_)*Sin[(c_.) + (d_.)*(x_)
], x_Symbol] :> Simp[e^m*(a + b*x^n)^(p + 1)*(Sin[c + d*x]/(b*n*(p + 1))),
x] - Simp[d*(e^m/(b*n*(p + 1)))   Int[(a + b*x^n)^(p + 1)*Cos[c + d*x], x],
 x] /; FreeQ[{a, b, c, d, e, m, n}, x] && ILtQ[p, -1] && EqQ[m, n - 1] && (
IntegerQ[n] || GtQ[e, 0])
```

## 3.103.4 Maple [C] (verified)

Result contains higher order function than in optimal. Order 9 vs. order 4.

Time = 0.74 (sec) , antiderivative size = 823, normalized size of antiderivative = 2.22

| method | result | size |
|---|---|---|
| derivativedivides | Expression too large to display | 823 |
| default | Expression too large to display | 823 |
| risch | Expression too large to display | 926 |

input
```
int(x^2*sin(d*x+c)/(b*x^3+a)^2,x,method=_RETURNVERBOSE)
```

output
```
1/d^3*(d^6*c^2*(sin(d*x+c)*(1/3/a/d^3*(d*x+c)-1/3*c/a/d^3)/(a*d^3-c^3*b+3*
b*c^2*(d*x+c)-3*b*c*(d*x+c)^2+b*(d*x+c)^3)+2/9/a/d^3/b*sum(1/(_R1^2-2*_R1*
c+c^2)*(-Si(-d*x+_R1-c)*cos(_R1)+Ci(d*x-_R1+c)*sin(_R1)),_R1=RootOf(_Z^3*b
-3*_Z^2*b*c+3*_Z*b*c^2+a*d^3-b*c^3))+1/9/a/d^3/b*sum(1/(-_RR1+c)*(Si(-d*x+
_RR1-c)*sin(_RR1)+Ci(d*x-_RR1+c)*cos(_RR1)),_RR1=RootOf(_Z^3*b-3*_Z^2*b*c+
3*_Z*b*c^2+a*d^3-b*c^3)))+sin(d*x+c)*(-2/3*c*d^3/a*(d*x+c)^2+2/3*c^2*d^3/a
*(d*x+c))/(a*d^3-c^3*b+3*b*c^2*(d*x+c)-3*b*c*(d*x+c)^2+b*(d*x+c)^3)-2/9*c*
d^3/a/b*sum((c+_R1)/(_R1^2-2*_R1*c+c^2)*(-Si(-d*x+_R1-c)*cos(_R1)+Ci(d*x-_
R1+c)*sin(_R1)),_R1=RootOf(_Z^3*b-3*_Z^2*b*c+3*_Z*b*c^2+a*d^3-b*c^3))-2/9*
c*d^3/a/b*sum(_RR1/(-_RR1+c)*(Si(-d*x+_RR1-c)*sin(_RR1)+Ci(d*x-_RR1+c)*cos
(_RR1)),_RR1=RootOf(_Z^3*b-3*_Z^2*b*c+3*_Z*b*c^2+a*d^3-b*c^3))+sin(d*x+c)*
(2/3*c*d^3/a*(d*x+c)^2-c^2*d^3/a*(d*x+c)-1/3*d^3*(a*d^3-b*c^3)/a/b)/(a*d^3
-c^3*b+3*b*c^2*(d*x+c)-3*b*c*(d*x+c)^2+b*(d*x+c)^3)+2/9*c*d^3/a/b*sum(_R1/
(_R1^2-2*_R1*c+c^2)*(-Si(-d*x+_R1-c)*cos(_R1)+Ci(d*x-_R1+c)*sin(_R1)),_R1=
RootOf(_Z^3*b-3*_Z^2*b*c+3*_Z*b*c^2+a*d^3-b*c^3))+1/9*d^3/a/b^2*sum((-2*_R
R1^2*b*c+3*_RR1*b*c^2+a*d^3-b*c^3)/(_RR1^2-2*_RR1*c+c^2)*(Si(-d*x+_RR1-c)*
sin(_RR1)+Ci(d*x-_RR1+c)*cos(_RR1)),_RR1=RootOf(_Z^3*b-3*_Z^2*b*c+3*_Z*b*c
^2+a*d^3-b*c^3)))
```

### 3.103.5 Fricas [C] (verification not implemented)

Result contains complex when optimal does not.

Time = 0.31 (sec) , antiderivative size = 482, normalized size of antiderivative = 1.30

$$\int \frac{x^2 \sin(c+dx)}{(a+bx^3)^2}\,dx$$

$$= \frac{\left(-i\,bx^3+\sqrt{3}(bx^3+a)-i\,a\right)\left(\frac{i\,ad^3}{b}\right)^{\frac{1}{3}}\mathrm{Ei}\left(-i\,dx+\frac{1}{2}\left(\frac{i\,ad^3}{b}\right)^{\frac{1}{3}}\left(-i\,\sqrt{3}-1\right)\right)e^{\left(\frac{1}{2}\left(\frac{i\,ad^3}{b}\right)^{\frac{1}{3}}\left(i\,\sqrt{3}+1\right)-i\,c\right)}+\left(i\,b\right.}{}$$

input
```
integrate(x^2*sin(d*x+c)/(b*x^3+a)^2,x, algorithm="fricas")
```

output
```
1/36*((-I*b*x^3 + sqrt(3)*(b*x^3 + a) - I*a)*(I*a*d^3/b)^(1/3)*Ei(-I*d*x +
 1/2*(I*a*d^3/b)^(1/3)*(-I*sqrt(3) - 1))*e^(1/2*(I*a*d^3/b)^(1/3)*(I*sqrt(
3) + 1) - I*c) + (I*b*x^3 - sqrt(3)*(b*x^3 + a) + I*a)*(-I*a*d^3/b)^(1/3)*
Ei(I*d*x + 1/2*(-I*a*d^3/b)^(1/3)*(-I*sqrt(3) - 1))*e^(1/2*(-I*a*d^3/b)^(1
/3)*(I*sqrt(3) + 1) + I*c) + (-I*b*x^3 - sqrt(3)*(b*x^3 + a) - I*a)*(I*a*d
^3/b)^(1/3)*Ei(-I*d*x + 1/2*(I*a*d^3/b)^(1/3)*(I*sqrt(3) - 1))*e^(1/2*(I*a
*d^3/b)^(1/3)*(-I*sqrt(3) + 1) - I*c) + (I*b*x^3 + sqrt(3)*(b*x^3 + a) + I
*a)*(-I*a*d^3/b)^(1/3)*Ei(I*d*x + 1/2*(-I*a*d^3/b)^(1/3)*(I*sqrt(3) - 1))*
e^(1/2*(-I*a*d^3/b)^(1/3)*(-I*sqrt(3) + 1) + I*c) - 2*(I*b*x^3 + I*a)*(-I*
a*d^3/b)^(1/3)*Ei(I*d*x + (-I*a*d^3/b)^(1/3))*e^(I*c - (-I*a*d^3/b)^(1/3))
 - 2*(-I*b*x^3 - I*a)*(I*a*d^3/b)^(1/3)*Ei(-I*d*x + (I*a*d^3/b)^(1/3))*e^(
-I*c - (I*a*d^3/b)^(1/3)) - 12*a*sin(d*x + c))/(a*b^2*x^3 + a^2*b)
```

### 3.103.6 Sympy [F(-1)]

Timed out.

$$\int \frac{x^2 \sin(c+dx)}{(a+bx^3)^2}\,dx = \text{Timed out}$$

input
```
integrate(x**2*sin(d*x+c)/(b*x**3+a)**2,x)
```

output
```
Timed out
```

### 3.103.7 Maxima [F]

$$\int \frac{x^2 \sin(c+dx)}{(a+bx^3)^2}\,dx = \int \frac{x^2 \sin{(dx+c)}}{(bx^3+a)^2}\,dx$$

input
```
integrate(x^2*sin(d*x+c)/(b*x^3+a)^2,x, algorithm="maxima")
```

output
```
-1/2*((cos(c)^2 + sin(c)^2)*d*x^2*cos(d*x + c) + 4*(cos(c)^2 + sin(c)^2)*x
*sin(d*x + c) + ((d*x^2*cos(c) - 4*x*sin(c))*cos(d*x + c)^2 + (d*x^2*cos(c
) - 4*x*sin(c))*sin(d*x + c)^2)*cos(d*x + 2*c) + 2*(((b^2*cos(c)^2 + b^2*s
in(c)^2)*d^2*x^6 + 2*(a*b*cos(c)^2 + a*b*sin(c)^2)*d^2*x^3 + (a^2*cos(c)^2
 + a^2*sin(c)^2)*d^2)*cos(d*x + c)^2 + ((b^2*cos(c)^2 + b^2*sin(c)^2)*d^2*
x^6 + 2*(a*b*cos(c)^2 + a*b*sin(c)^2)*d^2*x^3 + (a^2*cos(c)^2 + a^2*sin(c)
^2)*d^2)*sin(d*x + c)^2)*integrate(-(3*a*d*x*cos(d*x + c) - 2*(5*b*x^3 - a
)*sin(d*x + c))/(b^3*d^2*x^9 + 3*a*b^2*d^2*x^6 + 3*a^2*b*d^2*x^3 + a^3*d^2
), x) + 2*(((b^2*cos(c)^2 + b^2*sin(c)^2)*d^2*x^6 + 2*(a*b*cos(c)^2 + a*b*
sin(c)^2)*d^2*x^3 + (a^2*cos(c)^2 + a^2*sin(c)^2)*d^2)*cos(d*x + c)^2 + ((
b^2*cos(c)^2 + b^2*sin(c)^2)*d^2*x^6 + 2*(a*b*cos(c)^2 + a*b*sin(c)^2)*d^2
*x^3 + (a^2*cos(c)^2 + a^2*sin(c)^2)*d^2)*sin(d*x + c)^2)*integrate(-(3*a*
d*x*cos(d*x + c) - 2*(5*b*x^3 - a)*sin(d*x + c))/((b^3*d^2*x^9 + 3*a*b^2*d
^2*x^6 + 3*a^2*b*d^2*x^3 + a^3*d^2)*cos(d*x + c)^2 + (b^3*d^2*x^9 + 3*a*b^
2*d^2*x^6 + 3*a^2*b*d^2*x^3 + a^3*d^2)*sin(d*x + c)^2), x) + ((d*x^2*sin(c
) + 4*x*cos(c))*cos(d*x + c)^2 + (d*x^2*sin(c) + 4*x*cos(c))*sin(d*x + c)^
2)*sin(d*x + 2*c))/(((b^2*cos(c)^2 + b^2*sin(c)^2)*d^2*x^6 + 2*(a*b*cos(c)
^2 + a*b*sin(c)^2)*d^2*x^3 + (a^2*cos(c)^2 + a^2*sin(c)^2)*d^2)*cos(d*x +
c)^2 + ((b^2*cos(c)^2 + b^2*sin(c)^2)*d^2*x^6 + 2*(a*b*cos(c)^2 + a*b*sin(
c)^2)*d^2*x^3 + (a^2*cos(c)^2 + a^2*sin(c)^2)*d^2)*sin(d*x + c)^2)
```

### 3.103.8 Giac [F]

$$\int \frac{x^2 \sin(c+dx)}{(a+bx^3)^2} \, dx = \int \frac{x^2 \sin(dx+c)}{(bx^3+a)^2} \, dx$$

input
```
integrate(x^2*sin(d*x+c)/(b*x^3+a)^2,x, algorithm="giac")
```

output
```
integrate(x^2*sin(d*x + c)/(b*x^3 + a)^2, x)
```

### 3.103.9 Mupad [F(-1)]

Timed out.

$$\int \frac{x^2 \sin(c+dx)}{(a+bx^3)^2} dx = \int \frac{x^2 \sin(c+dx)}{(bx^3+a)^2} dx$$

input
```
int((x^2*sin(c + d*x))/(a + b*x^3)^2,x)
```

output
```
int((x^2*sin(c + d*x))/(a + b*x^3)^2, x)
```

# 3.104 $\int \frac{x\sin(c+dx)}{(a+bx^3)^2}\,dx$

### 3.104.1 Optimal result

Integrand size = 17, antiderivative size = 691

$$\begin{aligned}
\int \frac{x\sin(c+dx)}{(a+bx^3)^2}\,dx = &-\frac{d\cos\left(c+\frac{\sqrt[3]{-1}\sqrt[3]{a}d}{\sqrt[3]{b}}\right)\text{CosIntegral}\left(\frac{\sqrt[3]{-1}\sqrt[3]{a}d}{\sqrt[3]{b}}-dx\right)}{9ab} \\
&-\frac{d\cos\left(c-\frac{\sqrt[3]{a}d}{\sqrt[3]{b}}\right)\text{CosIntegral}\left(\frac{\sqrt[3]{a}d}{\sqrt[3]{b}}+dx\right)}{9ab} \\
&-\frac{d\cos\left(c-\frac{(-1)^{2/3}\sqrt[3]{a}d}{\sqrt[3]{b}}\right)\text{CosIntegral}\left(\frac{(-1)^{2/3}\sqrt[3]{a}d}{\sqrt[3]{b}}+dx\right)}{9ab} \\
&-\frac{\text{CosIntegral}\left(\frac{\sqrt[3]{a}d}{\sqrt[3]{b}}+dx\right)\sin\left(c-\frac{\sqrt[3]{a}d}{\sqrt[3]{b}}\right)}{9a^{4/3}b^{2/3}} \\
&-\frac{(-1)^{2/3}\,\text{CosIntegral}\left(\frac{\sqrt[3]{-1}\sqrt[3]{a}d}{\sqrt[3]{b}}-dx\right)\sin\left(c+\frac{\sqrt[3]{-1}\sqrt[3]{a}d}{\sqrt[3]{b}}\right)}{9a^{4/3}b^{2/3}} \\
&+\frac{\sqrt[3]{-1}\,\text{CosIntegral}\left(\frac{(-1)^{2/3}\sqrt[3]{a}d}{\sqrt[3]{b}}+dx\right)\sin\left(c-\frac{(-1)^{2/3}\sqrt[3]{a}d}{\sqrt[3]{b}}\right)}{9a^{4/3}b^{2/3}} \\
&+\frac{\sin(c+dx)}{3abx}-\frac{\sin(c+dx)}{3bx\,(a+bx^3)} \\
&+\frac{(-1)^{2/3}\cos\left(c+\frac{\sqrt[3]{-1}\sqrt[3]{a}d}{\sqrt[3]{b}}\right)\text{Si}\left(\frac{\sqrt[3]{-1}\sqrt[3]{a}d}{\sqrt[3]{b}}-dx\right)}{9a^{4/3}b^{2/3}} \\
&-\frac{d\sin\left(c+\frac{\sqrt[3]{-1}\sqrt[3]{a}d}{\sqrt[3]{b}}\right)\text{Si}\left(\frac{\sqrt[3]{-1}\sqrt[3]{a}d}{\sqrt[3]{b}}-dx\right)}{9ab} \\
&-\frac{\cos\left(c-\frac{\sqrt[3]{a}d}{\sqrt[3]{b}}\right)\text{Si}\left(\frac{\sqrt[3]{a}d}{\sqrt[3]{b}}+dx\right)}{9a^{4/3}b^{2/3}} \\
&+\frac{d\sin\left(c-\frac{\sqrt[3]{a}d}{\sqrt[3]{b}}\right)\text{Si}\left(\frac{\sqrt[3]{a}d}{\sqrt[3]{b}}+dx\right)}{9ab} \\
&+\frac{\sqrt[3]{-1}\cos\left(c-\frac{(-1)^{2/3}\sqrt[3]{a}d}{\sqrt[3]{b}}\right)\text{Si}\left(\frac{(-1)^{2/3}\sqrt[3]{a}d}{\sqrt[3]{b}}+dx\right)}{9a^{4/3}b^{2/3}} \\
&+\frac{d\sin\left(c-\frac{(-1)^{2/3}\sqrt[3]{a}d}{\sqrt[3]{b}}\right)\text{Si}\left(\frac{(-1)^{2/3}\sqrt[3]{a}d}{\sqrt[3]{b}}+dx\right)}{9ab}
\end{aligned}$$

output
```
-1/9*d*Ci(a^(1/3)*d/b^(1/3)+d*x)*cos(c-a^(1/3)*d/b^(1/3))/a/b-1/9*d*Ci((-1
)^(1/3)*a^(1/3)*d/b^(1/3)-d*x)*cos(c+(-1)^(1/3)*a^(1/3)*d/b^(1/3))/a/b-1/9
*d*Ci((-1)^(2/3)*a^(1/3)*d/b^(1/3)+d*x)*cos(c-(-1)^(2/3)*a^(1/3)*d/b^(1/3)
)/a/b-1/9*(-1)^(2/3)*cos(c+(-1)^(1/3)*a^(1/3)*d/b^(1/3))*Si(-(-1)^(1/3)*a^
(1/3)*d/b^(1/3)+d*x)/a^(4/3)/b^(2/3)-1/9*cos(c-a^(1/3)*d/b^(1/3))*Si(a^(1/
3)*d/b^(1/3)+d*x)/a^(4/3)/b^(2/3)+1/9*(-1)^(1/3)*cos(c-(-1)^(2/3)*a^(1/3)*
d/b^(1/3))*Si((-1)^(2/3)*a^(1/3)*d/b^(1/3)+d*x)/a^(4/3)/b^(2/3)-1/9*Ci(a^(
1/3)*d/b^(1/3)+d*x)*sin(c-a^(1/3)*d/b^(1/3))/a^(4/3)/b^(2/3)+1/9*d*Si(a^(1
/3)*d/b^(1/3)+d*x)*sin(c-a^(1/3)*d/b^(1/3))/a/b-1/9*(-1)^(2/3)*Ci((-1)^(1/
3)*a^(1/3)*d/b^(1/3)-d*x)*sin(c+(-1)^(1/3)*a^(1/3)*d/b^(1/3))/a^(4/3)/b^(2
/3)+1/9*d*Si(-(-1)^(1/3)*a^(1/3)*d/b^(1/3)+d*x)*sin(c+(-1)^(1/3)*a^(1/3)*d
/b^(1/3))/a/b+1/9*(-1)^(1/3)*Ci((-1)^(2/3)*a^(1/3)*d/b^(1/3)+d*x)*sin(c-(-
1)^(2/3)*a^(1/3)*d/b^(1/3))/a^(4/3)/b^(2/3)+1/9*d*Si((-1)^(2/3)*a^(1/3)*d/
b^(1/3)+d*x)*sin(c-(-1)^(2/3)*a^(1/3)*d/b^(1/3))/a/b+1/3*sin(d*x+c)/a/b/x-
1/3*sin(d*x+c)/b/x/(b*x^3+a)
```

### 3.104.2 Mathematica [C] (verified)

Result contains higher order function than in optimal. Order 9 vs. order 4 in optimal.

Time = 0.16 (sec) , antiderivative size = 408, normalized size of antiderivative = 0.59

$$\int \frac{x\sin(c+dx)}{(a+bx^3)^2}\,dx =$$

$$-\frac{(a+bx^3)\,\mathrm{RootSum}\Big[a+b\#1^3\&,\frac{-i\cos(c+d\#1)\,\mathrm{CosIntegral}(d(x-\#1))-\mathrm{CosIntegral}(d(x-\#1))\sin(c+d\#1)-\cos(c+d\#1)\mathrm{S}}{}}{}$$

input
```
Integrate[(x*Sin[c + d*x])/(a + b*x^3)^2,x]
```

output
```
-1/18*((a + b*x^3)*RootSum[a + b*#1^3 & , ((-I)*Cos[c + d*#1]*CosIntegral[
d*(x - #1)] - CosIntegral[d*(x - #1)]*Sin[c + d*#1] - Cos[c + d*#1]*SinInt
egral[d*(x - #1)] + I*Sin[c + d*#1]*SinIntegral[d*(x - #1)] + d*Cos[c + d*
#1]*CosIntegral[d*(x - #1)]*#1 - I*d*CosIntegral[d*(x - #1)]*Sin[c + d*#1]
*#1 - I*d*Cos[c + d*#1]*SinIntegral[d*(x - #1)]*#1 - d*Sin[c + d*#1]*SinIn
tegral[d*(x - #1)]*#1)/#1 & ] + (a + b*x^3)*RootSum[a + b*#1^3 & , (I*Cos[
c + d*#1]*CosIntegral[d*(x - #1)] - CosIntegral[d*(x - #1)]*Sin[c + d*#1]
- Cos[c + d*#1]*SinIntegral[d*(x - #1)] - I*Sin[c + d*#1]*SinIntegral[d*(x
 - #1)] + d*Cos[c + d*#1]*CosIntegral[d*(x - #1)]*#1 + I*d*CosIntegral[d*(
x - #1)]*Sin[c + d*#1]*#1 + I*d*Cos[c + d*#1]*SinIntegral[d*(x - #1)]*#1 -
 d*Sin[c + d*#1]*SinIntegral[d*(x - #1)]*#1)/#1 & ] - 6*b*x^2*Sin[c + d*x]
)/(a*b*(a + b*x^3))
```

### 3.104.3 Rubi [A] (verified)

Time = 1.72 (sec) , antiderivative size = 723, normalized size of antiderivative = 1.05, number of steps used = 5, number of rules used = 5, $\frac{\text{number of rules}}{\text{integrand size}} = 0.294$, Rules used = {3824, 3826, 2009, 3827, 2009}

Below are the steps used by Rubi to obtain the solution. The rule number used for the transformation is given above next to the arrow. The rules definitions used are listed below.

$$\int \frac{x\sin(c+dx)}{\left(a+bx^3\right)^2}dx$$

$$\Big\downarrow \ 3824$$

$$\frac{d\int \frac{\cos(c+dx)}{x(bx^3+a)}dx}{3b}-\frac{\int \frac{\sin(c+dx)}{x^2(bx^3+a)}dx}{3b}-\frac{\sin(c+dx)}{3bx\left(a+bx^3\right)}$$

$$\Big\downarrow \ 3826$$

$$\frac{d\int \frac{\cos(c+dx)}{x(bx^3+a)}dx}{3b}-\frac{\int \left(\frac{\sin(c+dx)}{ax^2}-\frac{bx\sin(c+dx)}{a(bx^3+a)}\right)dx}{3b}-\frac{\sin(c+dx)}{3bx\left(a+bx^3\right)}$$

$$\Big\downarrow \ 2009$$

$$\frac{d\int \frac{\cos(c+dx)}{x(bx^3+a)}dx}{3b}-\frac{\frac{\sqrt[3]{b}\sin\left(c-\frac{\sqrt[3]{a}d}{\sqrt[3]{b}}\right)\text{CosIntegral}\left(xd+\frac{\sqrt[3]{a}d}{\sqrt[3]{b}}\right)}{3a^{4/3}}+\frac{(-1)^{2/3}\sqrt[3]{b}\sin\left(\frac{\sqrt[3]{-1}\sqrt[3]{a}d}{\sqrt[3]{b}}+c\right)\text{CosIntegral}\left(\frac{\sqrt[3]{-1}\sqrt[3]{a}d}{\sqrt[3]{b}}-dx\right)}{3a^{4/3}}-\frac{\sqrt[3]{-1}\sqrt[3]{b}\sin\left(c-\frac{(-\cdots}{\cdots}\right.}{\cdots}}{\cdots}-\frac{\sin(c+dx)}{3bx\left(a+bx^3\right)}$$

$\Big\downarrow$ 3827

$$\frac{d\int\left(\frac{\cos(c+dx)}{ax}-\frac{bx^2\cos(c+dx)}{a(bx^3+a)}\right)dx}{3b}-$$

$$\frac{\frac{\sqrt[3]{b}\sin\left(c-\frac{\sqrt[3]{a}d}{\sqrt[3]{b}}\right)\text{CosIntegral}\left(xd+\frac{\sqrt[3]{a}d}{\sqrt[3]{b}}\right)}{3a^{4/3}}+\frac{(-1)^{2/3}\sqrt[3]{b}\sin\left(\frac{\sqrt[3]{-1}\sqrt[3]{a}d}{\sqrt[3]{b}}+c\right)\text{CosIntegral}\left(\frac{\sqrt[3]{-1}\sqrt[3]{a}d}{\sqrt[3]{b}}-dx\right)}{3a^{4/3}}-\frac{\sqrt[3]{-1}\sqrt[3]{b}\sin\left(c-\frac{(-}{}\right.}{}}{}$$

$$\frac{\sin(c+dx)}{3bx\,(a+bx^3)}$$

$\Big\downarrow$ 2009

$$-\frac{\frac{\sqrt[3]{b}\sin\left(c-\frac{\sqrt[3]{a}d}{\sqrt[3]{b}}\right)\text{CosIntegral}\left(xd+\frac{\sqrt[3]{a}d}{\sqrt[3]{b}}\right)}{3a^{4/3}}+\frac{(-1)^{2/3}\sqrt[3]{b}\sin\left(\frac{\sqrt[3]{-1}\sqrt[3]{a}d}{\sqrt[3]{b}}+c\right)\text{CosIntegral}\left(\frac{\sqrt[3]{-1}\sqrt[3]{a}d}{\sqrt[3]{b}}-dx\right)}{3a^{4/3}}-\frac{\sqrt[3]{-1}\sqrt[3]{b}\sin\left(c-\right.}{}}{}$$

$$\frac{d\left(-\frac{\cos\left(\frac{\sqrt[3]{-1}\sqrt[3]{a}d}{\sqrt[3]{b}}+c\right)\text{CosIntegral}\left(\frac{\sqrt[3]{-1}\sqrt[3]{a}d}{\sqrt[3]{b}}-dx\right)}{3a}-\frac{\cos\left(c-\frac{\sqrt[3]{a}d}{\sqrt[3]{b}}\right)\text{CosIntegral}\left(xd+\frac{\sqrt[3]{a}d}{\sqrt[3]{b}}\right)}{3a}-\frac{\cos\left(c-\frac{(-1)^{2/3}\sqrt[3]{a}d}{\sqrt[3]{b}}\right)\text{CosInte}}{3a}\right.}{}$$

$$\frac{\sin(c+dx)}{3bx\,(a+bx^3)}$$

input
```
Int[(x*Sin[c + d*x])/(a + b*x^3)^2,x]
```

## 3.104. $\int \frac{x\sin(c+dx)}{(a+bx^3)^2}\,dx$

output
```
-1/3*Sin[c + d*x]/(b*x*(a + b*x^3)) - ((d*Cos[c]*CosIntegral[d*x])/a + (b^
(1/3)*CosIntegral[(a^(1/3)*d)/b^(1/3) + d*x]*Sin[c - (a^(1/3)*d)/b^(1/3)])
/(3*a^(4/3)) + ((-1)^(2/3)*b^(1/3)*CosIntegral[((-1)^(1/3)*a^(1/3)*d)/b^(1
/3) - d*x]*Sin[c + ((-1)^(1/3)*a^(1/3)*d)/b^(1/3)])/(3*a^(4/3)) - ((-1)^(1
/3)*b^(1/3)*CosIntegral[((-1)^(2/3)*a^(1/3)*d)/b^(1/3) + d*x]*Sin[c - ((-1
)^(2/3)*a^(1/3)*d)/b^(1/3)])/(3*a^(4/3)) - Sin[c + d*x]/(a*x) - (d*Sin[c]*
SinIntegral[d*x])/a - ((-1)^(2/3)*b^(1/3)*Cos[c + ((-1)^(1/3)*a^(1/3)*d)/b
^(1/3)]*SinIntegral[((-1)^(1/3)*a^(1/3)*d)/b^(1/3) - d*x])/(3*a^(4/3)) + (
b^(1/3)*Cos[c - (a^(1/3)*d)/b^(1/3)]*SinIntegral[(a^(1/3)*d)/b^(1/3) + d*x
])/(3*a^(4/3)) - ((-1)^(1/3)*b^(1/3)*Cos[c - ((-1)^(2/3)*a^(1/3)*d)/b^(1/3
)]*SinIntegral[((-1)^(2/3)*a^(1/3)*d)/b^(1/3) + d*x])/(3*a^(4/3)))/(3*b) +
 (d*((Cos[c]*CosIntegral[d*x])/a - (Cos[c + ((-1)^(1/3)*a^(1/3)*d)/b^(1/3)
]*CosIntegral[((-1)^(1/3)*a^(1/3)*d)/b^(1/3) - d*x])/(3*a) - (Cos[c - (a^(
1/3)*d)/b^(1/3)]*CosIntegral[(a^(1/3)*d)/b^(1/3) + d*x])/(3*a) - (Cos[c -
((-1)^(2/3)*a^(1/3)*d)/b^(1/3)]*CosIntegral[((-1)^(2/3)*a^(1/3)*d)/b^(1/3)
 + d*x])/(3*a) - (Sin[c]*SinIntegral[d*x])/a - (Sin[c + ((-1)^(1/3)*a^(1/3
)*d)/b^(1/3)]*SinIntegral[((-1)^(1/3)*a^(1/3)*d)/b^(1/3) - d*x])/(3*a) + (
Sin[c - (a^(1/3)*d)/b^(1/3)]*SinIntegral[(a^(1/3)*d)/b^(1/3) + d*x])/(3*a)
 + (Sin[c - ((-1)^(2/3)*a^(1/3)*d)/b^(1/3)]*SinIntegral[((-1)^(2/3)*a^(1/3
)*d)/b^(1/3) + d*x])/(3*a)))/(3*b)
```

### 3.104.3.1 Defintions of rubi rules used

rule 2009
```
Int[u_, x_Symbol] :> Simp[IntSum[u, x], x] /; SumQ[u]
```

rule 3824
```
Int[(x_)^(m_.)*((a_) + (b_.)*(x_)^(n_))^(p_)*Sin[(c_.) + (d_.)*(x_)], x_Sym
bol] :> Simp[x^(m - n + 1)*(a + b*x^n)^(p + 1)*(Sin[c + d*x]/(b*n*(p + 1)))
, x] + (-Simp[(m - n + 1)/(b*n*(p + 1))   Int[x^(m - n)*(a + b*x^n)^(p + 1)
*Sin[c + d*x], x], x] - Simp[d/(b*n*(p + 1))   Int[x^(m - n + 1)*(a + b*x^n
)^(p + 1)*Cos[c + d*x], x], x]) /; FreeQ[{a, b, c, d, m}, x] && ILtQ[p, -1]
 && IGtQ[n, 0] && (GtQ[m - n + 1, 0] || GtQ[n, 2]) && RationalQ[m]
```

rule 3826
```
Int[(x_)^(m_.)*((a_) + (b_.)*(x_)^(n_))^(p_)*Sin[(c_.) + (d_.)*(x_)], x_Sym
bol] :> Int[ExpandIntegrand[Sin[c + d*x], x^m*(a + b*x^n)^p, x], x] /; Free
Q[{a, b, c, d, m}, x] && ILtQ[p, 0] && IGtQ[n, 0] && (EqQ[n, 2] || EqQ[p, -
1]) && IntegerQ[m]
```

rule 3827
```
Int[Cos[(c_.) + (d_.)*(x_)]*(x_)^(m_.)*((a_) + (b_.)*(x_)^(n_))^(p_), x_Sym
bol] :> Int[ExpandIntegrand[Cos[c + d*x], x^m*(a + b*x^n)^p, x], x] /; Free
Q[{a, b, c, d, m}, x] && ILtQ[p, 0] && IGtQ[n, 0] && (EqQ[n, 2] || EqQ[p, -
1]) && IntegerQ[m]
```

### 3.104.4 Maple [C] (verified)

Result contains higher order function than in optimal. Order 9 vs. order 4.

Time = 0.63 (sec) , antiderivative size = 508, normalized size of antiderivative = 0.74

| method | result |
|---|---|
| derivativedivides | $\frac{\frac{\sin(dx+c)\left(\frac{d^3(dx+c)^2}{3a}-\frac{c\,d^3(dx+c)}{3a}\right)}{a\,d^3-c^3b+3b\,c^2(dx+c)-3bc(dx+c)^2+b(dx+c)^3}+\frac{d^3\left(\sum_{\_R1=\text{RootOf}\left(b\_Z^3-3\_Z^2bc+3c^2b\_Z+a\,d^3-c^3b\right)}\frac{(c+\_R1)\left(-\text{Si}\left(-d\cdots\right.\right.}{\cdots}\right.}{9ab}}{\cdots}$ |
| default | $\frac{\frac{\sin(dx+c)\left(\frac{d^3(dx+c)^2}{3a}-\frac{c\,d^3(dx+c)}{3a}\right)}{a\,d^3-c^3b+3b\,c^2(dx+c)-3bc(dx+c)^2+b(dx+c)^3}+\frac{d^3\left(\sum_{\_R1=\text{RootOf}\left(b\_Z^3-3\_Z^2bc+3c^2b\_Z+a\,d^3-c^3b\right)}\frac{(c+\_R1)\left(-\text{Si}\left(-d\cdots\right.\right.}{\cdots}\right.}{9ab}}{\cdots}$ |
| risch | $\frac{dc\left(\sum_{\_R1=\text{RootOf}\left(-3i\_Z^2bc-id^3a+ibc^3+b\_Z^3-3c^2b\_Z\right)}\frac{\left(i\_R1+c-2i\right)e^{-\_R1}\,\text{Ei}_1\left(-idx-ic+\_R1\right)}{2ic\_R1-\_R1^2+c^2}\right)}{18ab}+\frac{d\left(\_R1=\text{R}\cdots\right.}{\cdots}$ |

input
```
int(x*sin(d*x+c)/(b*x^3+a)^2,x,method=_RETURNVERBOSE)
```

output
```
1/d^2*(sin(d*x+c)*(1/3*d^3/a*(d*x+c)^2-1/3*c*d^3/a*(d*x+c))/(a*d^3-c^3*b+3
*b*c^2*(d*x+c)-3*b*c*(d*x+c)^2+b*(d*x+c)^3)+1/9*d^3/a/b*sum((c+_R1)/(_R1^2
-2*_R1*c+c^2)*(-Si(-d*x+_R1-c)*cos(_R1)+Ci(d*x-_R1+c)*sin(_R1)),_R1=RootOf
(_Z^3*b-3*_Z^2*b*c+3*_Z*b*c^2+a*d^3-b*c^3))+1/9*d^3/a/b*sum(_RR1/(-_RR1+c)
*(Si(-d*x+_RR1-c)*sin(_RR1)+Ci(d*x-_RR1+c)*cos(_RR1)),_RR1=RootOf(_Z^3*b-3
*_Z^2*b*c+3*_Z*b*c^2+a*d^3-b*c^3))-d^6*c*(sin(d*x+c)*(1/3/a/d^3*(d*x+c)-1/
3*c/a/d^3)/(a*d^3-c^3*b+3*b*c^2*(d*x+c)-3*b*c*(d*x+c)^2+b*(d*x+c)^3)+2/9/a
/d^3/b*sum(1/(_R1^2-2*_R1*c+c^2)*(-Si(-d*x+_R1-c)*cos(_R1)+Ci(d*x-_R1+c)*s
in(_R1)),_R1=RootOf(_Z^3*b-3*_Z^2*b*c+3*_Z*b*c^2+a*d^3-b*c^3))+1/9/a/d^3/b
*sum(1/(-_RR1+c)*(Si(-d*x+_RR1-c)*sin(_RR1)+Ci(d*x-_RR1+c)*cos(_RR1)),_RR1
=RootOf(_Z^3*b-3*_Z^2*b*c+3*_Z*b*c^2+a*d^3-b*c^3))))
```

### 3.104.5 Fricas [C] (verification not implemented)

Result contains complex when optimal does not.

Time = 0.31 (sec) , antiderivative size = 655, normalized size of antiderivative = 0.95

$$\int \frac{x \sin(c+dx)}{(a+bx^3)^2}\,dx$$

$$= \frac{12\,abd^2x^2\sin(dx+c) - \left(2\,abd^3x^3 + 2\,a^2d^3 - \left(-i\,b^2x^3 - i\,ab - \sqrt{3}(b^2x^3+ab)\right)\left(\frac{i\,ad^3}{b}\right)^{\frac{2}{3}}\right)\mathrm{Ei}\left(-i\,dx + \frac{1}{2}\left(\right.\right.}{}$$

input
```
integrate(x*sin(d*x+c)/(b*x^3+a)^2,x, algorithm="fricas")
```

output
```
1/36*(12*a*b*d^2*x^2*sin(d*x + c) - (2*a*b*d^3*x^3 + 2*a^2*d^3 - (-I*b^2*x
^3 - I*a*b - sqrt(3)*(b^2*x^3 + a*b))*(I*a*d^3/b)^(2/3))*Ei(-I*d*x + 1/2*(
I*a*d^3/b)^(1/3)*(-I*sqrt(3) - 1))*e^(1/2*(I*a*d^3/b)^(1/3)*(I*sqrt(3) + 1
) - I*c) - (2*a*b*d^3*x^3 + 2*a^2*d^3 - (I*b^2*x^3 + I*a*b + sqrt(3)*(b^2*
x^3 + a*b))*(-I*a*d^3/b)^(2/3))*Ei(I*d*x + 1/2*(-I*a*d^3/b)^(1/3)*(-I*sqrt
(3) - 1))*e^(1/2*(-I*a*d^3/b)^(1/3)*(I*sqrt(3) + 1) + I*c) - (2*a*b*d^3*x^
3 + 2*a^2*d^3 - (-I*b^2*x^3 - I*a*b + sqrt(3)*(b^2*x^3 + a*b))*(I*a*d^3/b)
^(2/3))*Ei(-I*d*x + 1/2*(I*a*d^3/b)^(1/3)*(I*sqrt(3) - 1))*e^(1/2*(I*a*d^3
/b)^(1/3)*(-I*sqrt(3) + 1) - I*c) - (2*a*b*d^3*x^3 + 2*a^2*d^3 - (I*b^2*x^
3 + I*a*b - sqrt(3)*(b^2*x^3 + a*b))*(-I*a*d^3/b)^(2/3))*Ei(I*d*x + 1/2*(-
I*a*d^3/b)^(1/3)*(I*sqrt(3) - 1))*e^(1/2*(-I*a*d^3/b)^(1/3)*(-I*sqrt(3) +
1) + I*c) - 2*(a*b*d^3*x^3 + a^2*d^3 + (I*b^2*x^3 + I*a*b)*(-I*a*d^3/b)^(2
/3))*Ei(I*d*x + (-I*a*d^3/b)^(1/3))*e^(I*c - (-I*a*d^3/b)^(1/3)) - 2*(a*b*
d^3*x^3 + a^2*d^3 + (-I*b^2*x^3 - I*a*b)*(I*a*d^3/b)^(2/3))*Ei(-I*d*x + (I
*a*d^3/b)^(1/3))*e^(-I*c - (I*a*d^3/b)^(1/3)))/(a^2*b^2*d^2*x^3 + a^3*b*d^
2)
```

### 3.104.6 Sympy [F(-1)]

Timed out.

$$\int \frac{x \sin(c+dx)}{(a+bx^3)^2}\,dx = \text{Timed out}$$

input
```
integrate(x*sin(d*x+c)/(b*x**3+a)**2,x)
```

output
```
Timed out
```

### 3.104.7 Maxima [F]

$$\int \frac{x\sin(c+dx)}{(a+bx^3)^2}\,dx = \int \frac{x\sin(dx+c)}{(bx^3+a)^2}\,dx$$

input
```
integrate(x*sin(d*x+c)/(b*x^3+a)^2,x, algorithm="maxima")
```

output
```
-1/2*((cos(c)^2 + sin(c)^2)*x*cos(d*x + c) + (x*cos(d*x + c)^2*cos(c) + x*
cos(c)*sin(d*x + c)^2)*cos(d*x + 2*c) + 2*(((b^2*cos(c)^2 + b^2*sin(c)^2)*
d*x^6 + 2*(a*b*cos(c)^2 + a*b*sin(c)^2)*d*x^3 + (a^2*cos(c)^2 + a^2*sin(c)
^2)*d)*cos(d*x + c)^2 + ((b^2*cos(c)^2 + b^2*sin(c)^2)*d*x^6 + 2*(a*b*cos(
c)^2 + a*b*sin(c)^2)*d*x^3 + (a^2*cos(c)^2 + a^2*sin(c)^2)*d)*sin(d*x + c)
^2)*integrate(1/2*(5*b*x^3 - a)*cos(d*x + c)/(b^3*d*x^9 + 3*a*b^2*d*x^6 +
3*a^2*b*d*x^3 + a^3*d), x) + 2*(((b^2*cos(c)^2 + b^2*sin(c)^2)*d*x^6 + 2*(
a*b*cos(c)^2 + a*b*sin(c)^2)*d*x^3 + (a^2*cos(c)^2 + a^2*sin(c)^2)*d)*cos(
d*x + c)^2 + ((b^2*cos(c)^2 + b^2*sin(c)^2)*d*x^6 + 2*(a*b*cos(c)^2 + a*b*
sin(c)^2)*d*x^3 + (a^2*cos(c)^2 + a^2*sin(c)^2)*d)*sin(d*x + c)^2)*integra
te(1/2*(5*b*x^3 - a)*cos(d*x + c)/((b^3*d*x^9 + 3*a*b^2*d*x^6 + 3*a^2*b*d*
x^3 + a^3*d)*cos(d*x + c)^2 + (b^3*d*x^9 + 3*a*b^2*d*x^6 + 3*a^2*b*d*x^3 +
 a^3*d)*sin(d*x + c)^2), x) + (x*cos(d*x + c)^2*sin(c) + x*sin(d*x + c)^2*
sin(c))*sin(d*x + 2*c))/(((b^2*cos(c)^2 + b^2*sin(c)^2)*d*x^6 + 2*(a*b*cos
(c)^2 + a*b*sin(c)^2)*d*x^3 + (a^2*cos(c)^2 + a^2*sin(c)^2)*d)*cos(d*x + c
)^2 + ((b^2*cos(c)^2 + b^2*sin(c)^2)*d*x^6 + 2*(a*b*cos(c)^2 + a*b*sin(c)^
2)*d*x^3 + (a^2*cos(c)^2 + a^2*sin(c)^2)*d)*sin(d*x + c)^2)
```

### 3.104.8 Giac [F]

$$\int \frac{x\sin(c+dx)}{(a+bx^3)^2}\,dx = \int \frac{x\sin(dx+c)}{(bx^3+a)^2}\,dx$$

input
```
integrate(x*sin(d*x+c)/(b*x^3+a)^2,x, algorithm="giac")
```

output
```
integrate(x*sin(d*x + c)/(b*x^3 + a)^2, x)
```

### 3.104.9 Mupad [F(-1)]

Timed out.

$$\int \frac{x\sin(c+dx)}{\left(a+bx^3\right)^2}\,dx=\int \frac{x\,\sin\left(c+d\,x\right)}{{\left(b\,x^3+a\right)}^2}\,dx$$

input
```
int((x*sin(c + d*x))/(a + b*x^3)^2,x)
```

output
```
int((x*sin(c + d*x))/(a + b*x^3)^2, x)
```

# 3.105 $\int \frac{\sin(c+dx)}{(a+bx^3)^2} \, dx$

### 3.105.1 Optimal result

Integrand size $= 16$, antiderivative size $= 735$

$$\int \frac{\sin(c+dx)}{(a+bx^3)^2}\,dx = \frac{(-1)^{2/3}d\cos\left(c+\frac{\sqrt[3]{-1}\sqrt[3]{a}d}{\sqrt[3]{b}}\right)\text{CosIntegral}\left(\frac{\sqrt[3]{-1}\sqrt[3]{a}d}{\sqrt[3]{b}}-dx\right)}{9a^{4/3}b^{2/3}}$$
$$+\frac{d\cos\left(c-\frac{\sqrt[3]{a}d}{\sqrt[3]{b}}\right)\text{CosIntegral}\left(\frac{\sqrt[3]{a}d}{\sqrt[3]{b}}+dx\right)}{9a^{4/3}b^{2/3}}$$
$$-\frac{\sqrt[3]{-1}d\cos\left(c-\frac{(-1)^{2/3}\sqrt[3]{a}d}{\sqrt[3]{b}}\right)\text{CosIntegral}\left(\frac{(-1)^{2/3}\sqrt[3]{a}d}{\sqrt[3]{b}}+dx\right)}{9a^{4/3}b^{2/3}}$$
$$+\frac{2\,\text{CosIntegral}\left(\frac{\sqrt[3]{a}d}{\sqrt[3]{b}}+dx\right)\sin\left(c-\frac{\sqrt[3]{a}d}{\sqrt[3]{b}}\right)}{9a^{5/3}\sqrt[3]{b}}$$
$$-\frac{2\sqrt[3]{-1}\,\text{CosIntegral}\left(\frac{\sqrt[3]{-1}\sqrt[3]{a}d}{\sqrt[3]{b}}-dx\right)\sin\left(c+\frac{\sqrt[3]{-1}\sqrt[3]{a}d}{\sqrt[3]{b}}\right)}{9a^{5/3}\sqrt[3]{b}}$$
$$+\frac{2(-1)^{2/3}\,\text{CosIntegral}\left(\frac{(-1)^{2/3}\sqrt[3]{a}d}{\sqrt[3]{b}}+dx\right)\sin\left(c-\frac{(-1)^{2/3}\sqrt[3]{a}d}{\sqrt[3]{b}}\right)}{9a^{5/3}\sqrt[3]{b}}$$
$$+\frac{\sin(c+dx)}{3abx^2}-\frac{\sin(c+dx)}{3bx^2(a+bx^3)}$$
$$+\frac{2\sqrt[3]{-1}\cos\left(c+\frac{\sqrt[3]{-1}\sqrt[3]{a}d}{\sqrt[3]{b}}\right)\text{Si}\left(\frac{\sqrt[3]{-1}\sqrt[3]{a}d}{\sqrt[3]{b}}-dx\right)}{9a^{5/3}\sqrt[3]{b}}$$
$$+\frac{(-1)^{2/3}d\sin\left(c+\frac{\sqrt[3]{-1}\sqrt[3]{a}d}{\sqrt[3]{b}}\right)\text{Si}\left(\frac{\sqrt[3]{-1}\sqrt[3]{a}d}{\sqrt[3]{b}}-dx\right)}{9a^{4/3}b^{2/3}}$$
$$+\frac{2\cos\left(c-\frac{\sqrt[3]{a}d}{\sqrt[3]{b}}\right)\text{Si}\left(\frac{\sqrt[3]{a}d}{\sqrt[3]{b}}+dx\right)}{9a^{5/3}\sqrt[3]{b}}$$
$$-\frac{d\sin\left(c-\frac{\sqrt[3]{a}d}{\sqrt[3]{b}}\right)\text{Si}\left(\frac{\sqrt[3]{a}d}{\sqrt[3]{b}}+dx\right)}{9a^{4/3}b^{2/3}}$$
$$+\frac{2(-1)^{2/3}\cos\left(c-\frac{(-1)^{2/3}\sqrt[3]{a}d}{\sqrt[3]{b}}\right)\text{Si}\left(\frac{(-1)^{2/3}\sqrt[3]{a}d}{\sqrt[3]{b}}+dx\right)}{9a^{5/3}\sqrt[3]{b}}$$
$$+\frac{\sqrt[3]{-1}d\sin\left(c-\frac{(-1)^{2/3}\sqrt[3]{a}d}{\sqrt[3]{b}}\right)\text{Si}\left(\frac{(-1)^{2/3}\sqrt[3]{a}d}{\sqrt[3]{b}}+dx\right)}{9a^{4/3}b^{2/3}}$$

output
```
1/9*d*Ci(a^(1/3)*d/b^(1/3)+d*x)*cos(c-a^(1/3)*d/b^(1/3))/a^(4/3)/b^(2/3)+1
/9*(-1)^(2/3)*d*Ci((-1)^(1/3)*a^(1/3)*d/b^(1/3)-d*x)*cos(c+(-1)^(1/3)*a^(1
/3)*d/b^(1/3))/a^(4/3)/b^(2/3)-1/9*(-1)^(1/3)*d*Ci((-1)^(2/3)*a^(1/3)*d/b^
(1/3)+d*x)*cos(c-(-1)^(2/3)*a^(1/3)*d/b^(1/3))/a^(4/3)/b^(2/3)-2/9*(-1)^(1
/3)*cos(c+(-1)^(1/3)*a^(1/3)*d/b^(1/3))*Si(-(-1)^(1/3)*a^(1/3)*d/b^(1/3)+d
*x)/a^(5/3)/b^(1/3)+2/9*cos(c-a^(1/3)*d/b^(1/3))*Si(a^(1/3)*d/b^(1/3)+d*x)
/a^(5/3)/b^(1/3)+2/9*(-1)^(2/3)*cos(c-(-1)^(2/3)*a^(1/3)*d/b^(1/3))*Si((-1
)^(2/3)*a^(1/3)*d/b^(1/3)+d*x)/a^(5/3)/b^(1/3)+2/9*Ci(a^(1/3)*d/b^(1/3)+d*
x)*sin(c-a^(1/3)*d/b^(1/3))/a^(5/3)/b^(1/3)-1/9*d*Si(a^(1/3)*d/b^(1/3)+d*x
)*sin(c-a^(1/3)*d/b^(1/3))/a^(4/3)/b^(2/3)-2/9*(-1)^(1/3)*Ci((-1)^(1/3)*a^
(1/3)*d/b^(1/3)-d*x)*sin(c+(-1)^(1/3)*a^(1/3)*d/b^(1/3))/a^(5/3)/b^(1/3)-1
/9*(-1)^(2/3)*d*Si(-(-1)^(1/3)*a^(1/3)*d/b^(1/3)+d*x)*sin(c+(-1)^(1/3)*a^(
1/3)*d/b^(1/3))/a^(4/3)/b^(2/3)+2/9*(-1)^(2/3)*Ci((-1)^(2/3)*a^(1/3)*d/b^(
1/3)+d*x)*sin(c-(-1)^(2/3)*a^(1/3)*d/b^(1/3))/a^(5/3)/b^(1/3)+1/9*(-1)^(1/
3)*d*Si((-1)^(2/3)*a^(1/3)*d/b^(1/3)+d*x)*sin(c-(-1)^(2/3)*a^(1/3)*d/b^(1/
3))/a^(4/3)/b^(2/3)+1/3*sin(d*x+c)/a/b/x^2-1/3*sin(d*x+c)/b/x^2/(b*x^3+a)
```

### 3.105.2 Mathematica [C] (verified)

Result contains higher order function than in optimal. Order 9 vs. order 4 in optimal.

Time = 0.16 (sec) , antiderivative size = 406, normalized size of antiderivative = 0.55

$$\int \frac{\sin(c+dx)}{(a+bx^3)^2}\,dx =$$

$$-\frac{(a+bx^3)\,\text{RootSum}\left[a+b\#1^3\&,\frac{-2i\cos(c+d\#1)\,\text{CosIntegral}(d(x-\#1))-2\,\text{CosIntegral}(d(x-\#1))\sin(c+d\#1)-2\cos(c+d\#\ldots}{\ldots}\right.}{\ldots}$$

input
```
Integrate[Sin[c + d*x]/(a + b*x^3)^2,x]
```

output
```
-1/18*((a + b*x^3)*RootSum[a + b*#1^3 & , ((-2*I)*Cos[c + d*#1]*CosIntegra
l[d*(x - #1)] - 2*CosIntegral[d*(x - #1)]*Sin[c + d*#1] - 2*Cos[c + d*#1]*
SinIntegral[d*(x - #1)] + (2*I)*Sin[c + d*#1]*SinIntegral[d*(x - #1)] + d*
Cos[c + d*#1]*CosIntegral[d*(x - #1)]*#1 - I*d*CosIntegral[d*(x - #1)]*Sin
[c + d*#1]*#1 - I*d*Cos[c + d*#1]*SinIntegral[d*(x - #1)]*#1 - d*Sin[c + d
*#1]*SinIntegral[d*(x - #1)]*#1)/#1^2 & ] + (a + b*x^3)*RootSum[a + b*#1^3
 & , ((2*I)*Cos[c + d*#1]*CosIntegral[d*(x - #1)] - 2*CosIntegral[d*(x - #
1)]*Sin[c + d*#1] - 2*Cos[c + d*#1]*SinIntegral[d*(x - #1)] - (2*I)*Sin[c
+ d*#1]*SinIntegral[d*(x - #1)] + d*Cos[c + d*#1]*CosIntegral[d*(x - #1)]*
#1 + I*d*CosIntegral[d*(x - #1)]*Sin[c + d*#1]*#1 + I*d*Cos[c + d*#1]*SinI
ntegral[d*(x - #1)]*#1 - d*Sin[c + d*#1]*SinIntegral[d*(x - #1)]*#1)/#1^2
& ] - 6*b*x*Sin[c + d*x])/(a*b*(a + b*x^3))
```

### 3.105.3 Rubi [A] (verified)

Time = 1.84 (sec) , antiderivative size = 830, normalized size of antiderivative = 1.13, number of steps used = 5, number of rules used = 5, $\frac{\text{number of rules}}{\text{integrand size}} = 0.312$, Rules used = {3812, 3826, 2009, 3827, 2009}

Below are the steps used by Rubi to obtain the solution. The rule number used for the transformation is given above next to the arrow. The rules definitions used are listed below.

$$\int \frac{\sin(c+dx)}{(a+bx^3)^2} \, dx$$

$$\Big\downarrow \text{3812}$$

$$-\frac{2\int \frac{\sin(c+dx)}{x^3(bx^3+a)}dx}{3b}+\frac{d\int \frac{\cos(c+dx)}{x^2(bx^3+a)}dx}{3b}-\frac{\sin(c+dx)}{3bx^2(a+bx^3)}$$

$$\Big\downarrow \text{3826}$$

$$-\frac{2\int \left(\frac{\sin(c+dx)}{ax^3}-\frac{b\sin(c+dx)}{a(bx^3+a)}\right)dx}{3b}+\frac{d\int \frac{\cos(c+dx)}{x^2(bx^3+a)}dx}{3b}-\frac{\sin(c+dx)}{3bx^2(a+bx^3)}$$

$$\Big\downarrow \text{2009}$$

$$\frac{d\int \frac{\cos(c+dx)}{x^2(bx^3+a)}dx}{3b} - \frac{2\left(-\frac{b^{2/3}\sin\left(c-\frac{\sqrt[3]{a}d}{\sqrt[3]{b}}\right)\text{CosIntegral}\left(xd+\frac{\sqrt[3]{a}d}{\sqrt[3]{b}}\right)}{3a^{5/3}} + \frac{\sqrt[3]{-1}b^{2/3}\sin\left(\frac{\sqrt[3]{-1}\sqrt[3]{a}d}{\sqrt[3]{b}}+c\right)\text{CosIntegral}\left(\frac{\sqrt[3]{-1}\sqrt[3]{a}d}{\sqrt[3]{b}}-dx\right)}{3a^{5/3}} - \frac{(-1)^{2/3}b^{2/3}\sin(}{}\right.}{}$$

$$\frac{\sin(c+dx)}{3bx^2(a+bx^3)}$$

$\downarrow$ 3827

$$\frac{d\int \left(\frac{\cos(c+dx)}{ax^2} - \frac{bx\cos(c+dx)}{a(bx^3+a)}\right)dx}{3b} - \frac{2\left(-\frac{b^{2/3}\sin\left(c-\frac{\sqrt[3]{a}d}{\sqrt[3]{b}}\right)\text{CosIntegral}\left(xd+\frac{\sqrt[3]{a}d}{\sqrt[3]{b}}\right)}{3a^{5/3}} + \frac{\sqrt[3]{-1}b^{2/3}\sin\left(\frac{\sqrt[3]{-1}\sqrt[3]{a}d}{\sqrt[3]{b}}+c\right)\text{CosIntegral}\left(\frac{\sqrt[3]{-1}\sqrt[3]{a}d}{\sqrt[3]{b}}-dx\right)}{3a^{5/3}} - \frac{(-1)^{2/3}b^{2/3}\sin(}{}\right.}{}$$

$$\frac{\sin(c+dx)}{3bx^2(a+bx^3)}$$

$\downarrow$ 2009

$$-\frac{\sin(c+dx)}{3bx^2(bx^3+a)} - \frac{2\left(-\frac{\text{CosIntegral}(dx)\sin(c)d^2}{2a} - \frac{\cos(c)\text{Si}(dx)d^2}{2a} - \frac{\cos(c+dx)d}{2ax} - \frac{b^{2/3}\text{CosIntegral}\left(xd+\frac{\sqrt[3]{a}d}{\sqrt[3]{b}}\right)\sin\left(c-\frac{\sqrt[3]{a}d}{\sqrt[3]{b}}\right)}{3a^{5/3}} + \frac{\sqrt[3]{-1}b^{2/3}\text{CosIntegral}}{}\right.}{}$$

$$\frac{d\left(-\frac{\cos(c+dx)}{ax} + \frac{(-1)^{2/3}\sqrt[3]{b}\cos\left(c+\frac{\sqrt[3]{-1}\sqrt[3]{a}d}{\sqrt[3]{b}}\right)\text{CosIntegral}\left(\frac{\sqrt[3]{-1}\sqrt[3]{a}d}{\sqrt[3]{b}}-dx\right)}{3a^{4/3}} + \frac{\sqrt[3]{b}\cos\left(c-\frac{\sqrt[3]{a}d}{\sqrt[3]{b}}\right)\text{CosIntegral}\left(xd+\frac{\sqrt[3]{a}d}{\sqrt[3]{b}}\right)}{3a^{4/3}} - \right.}{}$$

input
```
Int[Sin[c + d*x]/(a + b*x^3)^2,x]
```

3.105. $\int \frac{\sin(c+dx)}{(a+bx^3)^2}\,dx$

output
```
-1/3*Sin[c + d*x]/(b*x^2*(a + b*x^3)) - (2*(-1/2*(d*Cos[c + d*x])/(a*x) -
(d^2*CosIntegral[d*x]*Sin[c])/(2*a) - (b^(2/3)*CosIntegral[(a^(1/3)*d)/b^(
1/3) + d*x]*Sin[c - (a^(1/3)*d)/b^(1/3)])/(3*a^(5/3)) + ((-1)^(1/3)*b^(2/3
)*CosIntegral[((-1)^(1/3)*a^(1/3)*d)/b^(1/3) - d*x]*Sin[c + ((-1)^(1/3)*a^
(1/3)*d)/b^(1/3)])/(3*a^(5/3)) - ((-1)^(2/3)*b^(2/3)*CosIntegral[((-1)^(2/
3)*a^(1/3)*d)/b^(1/3) + d*x]*Sin[c - ((-1)^(2/3)*a^(1/3)*d)/b^(1/3)])/(3*a
^(5/3)) - Sin[c + d*x]/(2*a*x^2) - (d^2*Cos[c]*SinIntegral[d*x])/(2*a) - (
(-1)^(1/3)*b^(2/3)*Cos[c + ((-1)^(1/3)*a^(1/3)*d)/b^(1/3)]*SinIntegral[((-
1)^(1/3)*a^(1/3)*d)/b^(1/3) - d*x])/(3*a^(5/3)) - (b^(2/3)*Cos[c - (a^(1/3
)*d)/b^(1/3)]*SinIntegral[(a^(1/3)*d)/b^(1/3) + d*x])/(3*a^(5/3)) - ((-1)^
(2/3)*b^(2/3)*Cos[c - ((-1)^(2/3)*a^(1/3)*d)/b^(1/3)]*SinIntegral[((-1)^(2
/3)*a^(1/3)*d)/b^(1/3) + d*x])/(3*a^(5/3))))/(3*b) + (d*(-(Cos[c + d*x]/(a
*x)) + ((-1)^(2/3)*b^(1/3)*Cos[c + ((-1)^(1/3)*a^(1/3)*d)/b^(1/3)]*CosInte
gral[((-1)^(1/3)*a^(1/3)*d)/b^(1/3) - d*x])/(3*a^(4/3)) + (b^(1/3)*Cos[c -
 (a^(1/3)*d)/b^(1/3)]*CosIntegral[(a^(1/3)*d)/b^(1/3) + d*x])/(3*a^(4/3))
- ((-1)^(1/3)*b^(1/3)*Cos[c - ((-1)^(2/3)*a^(1/3)*d)/b^(1/3)]*CosIntegral[
((-1)^(2/3)*a^(1/3)*d)/b^(1/3) + d*x])/(3*a^(4/3)) - (d*CosIntegral[d*x]*S
in[c])/a - (d*Cos[c]*SinIntegral[d*x])/a + ((-1)^(2/3)*b^(1/3)*Sin[c + ((-
1)^(1/3)*a^(1/3)*d)/b^(1/3)]*SinIntegral[((-1)^(1/3)*a^(1/3)*d)/b^(1/3) -
d*x])/(3*a^(4/3)) - (b^(1/3)*Sin[c - (a^(1/3)*d)/b^(1/3)]*SinIntegral[(...
```

### 3.105.3.1 Defintions of rubi rules used

rule 2009
```
Int[u_, x_Symbol] :> Simp[IntSum[u, x], x] /; SumQ[u]
```

rule 3812
```
Int[((a_) + (b_.)*(x_)^(n_))^(p_)*Sin[(c_.) + (d_.)*(x_)], x_Symbol] :> Sim
p[x^(-n + 1)*(a + b*x^n)^(p + 1)*(Sin[c + d*x]/(b*n*(p + 1))), x] + (-Simp[
(-n + 1)/(b*n*(p + 1))   Int[((a + b*x^n)^(p + 1)*Sin[c + d*x])/x^n, x], x]
 - Simp[d/(b*n*(p + 1))   Int[x^(-n + 1)*(a + b*x^n)^(p + 1)*Cos[c + d*x],
x], x]) /; FreeQ[{a, b, c, d}, x] && ILtQ[p, -1] && IGtQ[n, 2]
```

rule 3826
```
Int[(x_)^(m_.)*((a_) + (b_.)*(x_)^(n_))^(p_)*Sin[(c_.) + (d_.)*(x_)], x_Sym
bol] :> Int[ExpandIntegrand[Sin[c + d*x], x^m*(a + b*x^n)^p, x], x] /; Free
Q[{a, b, c, d, m}, x] && ILtQ[p, 0] && IGtQ[n, 0] && (EqQ[n, 2] || EqQ[p, -
1]) && IntegerQ[m]
```

---

3.105. $\int \frac{\sin(c+dx)}{(a+bx^3)^2} dx$

rule 3827
```
Int[Cos[(c_.) + (d_.)*(x_)]*(x_)^(m_.)*((a_) + (b_.)*(x_)^(n_))^(p_), x_Sym
bol] :> Int[ExpandIntegrand[Cos[c + d*x], x^m*(a + b*x^n)^p, x], x] /; Free
Q[{a, b, c, d, m}, x] && ILtQ[p, 0] && IGtQ[n, 0] && (EqQ[n, 2] || EqQ[p, -
1]) && IntegerQ[m]
```

### 3.105.4 Maple [C] (verified)

Result contains higher order function than in optimal. Order 9 vs. order 4.

Time = 0.53 (sec) , antiderivative size = 248, normalized size of antiderivative = 0.34

| method | result |
|---|---|
| derivativedivides | $d^5 \left( \frac{\sin(dx+c)\left(\frac{dx+c}{3a\,d^3} - \frac{c}{3a\,d^3}\right)}{a\,d^3 - c^3 b + 3b\,c^2(dx+c) - 3bc(dx+c)^2 + b(dx+c)^3} + \frac{2\left(\sum_{\_R1=\mathrm{RootOf}\left(b\_Z^3 - 3\_Z^2 bc + 3c^2 b\_Z + a\,d^3 - c^3 b\right)} \frac{-\mathrm{Si}\left(-dx \right.}{}\right.}{9a\,d^3} \right.$ |
| default | $d^5 \left( \frac{\sin(dx+c)\left(\frac{dx+c}{3a\,d^3} - \frac{c}{3a\,d^3}\right)}{a\,d^3 - c^3 b + 3b\,c^2(dx+c) - 3bc(dx+c)^2 + b(dx+c)^3} + \frac{2\left(\sum_{\_R1=\mathrm{RootOf}\left(b\_Z^3 - 3\_Z^2 bc + 3c^2 b\_Z + a\,d^3 - c^3 b\right)} \frac{-\mathrm{Si}\left(-dx \right.}{}\right.}{9a\,d^3} \right.$ |
| risch | $-\frac{d^2\left(\sum_{\_R1=\mathrm{RootOf}\left(-3i\_Z^2 bc - id^3 a + ibc^3 + b\_Z^3 - 3c^2 b\_Z\right)} \frac{\left(i\_R1 + c - 2i\right) e^{-\_R1} \mathrm{Ei}_1\left(-idx - ic + \_R1\right)}{2ic\_R1 - \_R1^2 + c^2}\right)}{18ab} - \frac{d^2\left(\_R \right.}{}$ |

input
```
int(sin(d*x+c)/(b*x^3+a)^2,x,method=_RETURNVERBOSE)
```

output
```
d^5*(sin(d*x+c)*(1/3/a/d^3*(d*x+c)-1/3*c/a/d^3)/(a*d^3-c^3*b+3*b*c^2*(d*x+
c)-3*b*c*(d*x+c)^2+b*(d*x+c)^3)+2/9/a/d^3/b*sum(1/(_R1^2-2*_R1*c+c^2)*(-Si
(-d*x+_R1-c)*cos(_R1)+Ci(d*x-_R1+c)*sin(_R1)),_R1=RootOf(_Z^3*b-3*_Z^2*b*c
+3*_Z*b*c^2+a*d^3-b*c^3))+1/9/a/d^3/b*sum(1/(-_RR1+c)*(Si(-d*x+_RR1-c)*sin
(_RR1)+Ci(d*x-_RR1+c)*cos(_RR1)),_RR1=RootOf(_Z^3*b-3*_Z^2*b*c+3*_Z*b*c^2+
a*d^3-b*c^3)))
```

### 3.105.5 Fricas [C] (verification not implemented)

Result contains complex when optimal does not.

Time = 0.30 (sec) , antiderivative size = 669, normalized size of antiderivative = 0.91

$$\int \frac{\sin(c+dx)}{(a+bx^3)^2}\,dx$$

$$= \frac{12\,adx\sin\left(dx+c\right)+\left(\left(bx^3+\sqrt{3}(-i\,bx^3-i\,a)+a\right)\left(\frac{i\,ad^3}{b}\right)^{\frac{2}{3}}+2\left(bx^3-\sqrt{3}(-i\,bx^3-i\,a)+a\right)\left(\frac{i\,ad^3}{b}\right)^{\frac{1}{3}}\right)\mathrm{I}}{}$$

input

```
integrate(sin(d*x+c)/(b*x^3+a)^2,x, algorithm="fricas")
```

output

```
1/36*(12*a*d*x*sin(d*x + c) + ((b*x^3 + sqrt(3)*(-I*b*x^3 - I*a) + a)*(I*a
*d^3/b)^(2/3) + 2*(b*x^3 - sqrt(3)*(-I*b*x^3 - I*a) + a)*(I*a*d^3/b)^(1/3)
)*Ei(-I*d*x + 1/2*(I*a*d^3/b)^(1/3)*(-I*sqrt(3) - 1))*e^(1/2*(I*a*d^3/b)^(
1/3)*(I*sqrt(3) + 1) - I*c) + ((b*x^3 + sqrt(3)*(-I*b*x^3 - I*a) + a)*(-I*
a*d^3/b)^(2/3) + 2*(b*x^3 - sqrt(3)*(-I*b*x^3 - I*a) + a)*(-I*a*d^3/b)^(1/
3))*Ei(I*d*x + 1/2*(-I*a*d^3/b)^(1/3)*(-I*sqrt(3) - 1))*e^(1/2*(-I*a*d^3/b
)^(1/3)*(I*sqrt(3) + 1) + I*c) + ((b*x^3 + sqrt(3)*(I*b*x^3 + I*a) + a)*(I
*a*d^3/b)^(2/3) + 2*(b*x^3 - sqrt(3)*(I*b*x^3 + I*a) + a)*(I*a*d^3/b)^(1/3
))*Ei(-I*d*x + 1/2*(I*a*d^3/b)^(1/3)*(I*sqrt(3) - 1))*e^(1/2*(I*a*d^3/b)^(
1/3)*(-I*sqrt(3) + 1) - I*c) + ((b*x^3 + sqrt(3)*(I*b*x^3 + I*a) + a)*(-I*
a*d^3/b)^(2/3) + 2*(b*x^3 - sqrt(3)*(I*b*x^3 + I*a) + a)*(-I*a*d^3/b)^(1/3
))*Ei(I*d*x + 1/2*(-I*a*d^3/b)^(1/3)*(I*sqrt(3) - 1))*e^(1/2*(-I*a*d^3/b)^
(1/3)*(-I*sqrt(3) + 1) + I*c) - 2*((b*x^3 + a)*(-I*a*d^3/b)^(2/3) + 2*(b*x
^3 + a)*(-I*a*d^3/b)^(1/3))*Ei(I*d*x + (-I*a*d^3/b)^(1/3))*e^(I*c - (-I*a*
d^3/b)^(1/3)) - 2*((b*x^3 + a)*(I*a*d^3/b)^(2/3) + 2*(b*x^3 + a)*(I*a*d^3/
b)^(1/3))*Ei(-I*d*x + (I*a*d^3/b)^(1/3))*e^(-I*c - (I*a*d^3/b)^(1/3)))/(a^
2*b*d*x^3 + a^3*d)
```

### 3.105.6 Sympy [F(-1)]

Timed out.

$$\int \frac{\sin(c+dx)}{(a+bx^3)^2}\,dx = \text{Timed out}$$

input

```
integrate(sin(d*x+c)/(b*x**3+a)**2,x)
```

output
```
Timed out
```

### 3.105.7 Maxima [F]

$$\int \frac{\sin(c+dx)}{(a+bx^3)^2}\,dx = \int \frac{\sin(dx+c)}{(bx^3+a)^2}\,dx$$

input
```
integrate(sin(d*x+c)/(b*x^3+a)^2,x, algorithm="maxima")
```

output
```
integrate(sin(d*x + c)/(b*x^3 + a)^2, x)
```

### 3.105.8 Giac [F]

$$\int \frac{\sin(c+dx)}{(a+bx^3)^2}\,dx = \int \frac{\sin(dx+c)}{(bx^3+a)^2}\,dx$$

input
```
integrate(sin(d*x+c)/(b*x^3+a)^2,x, algorithm="giac")
```

output
```
integrate(sin(d*x + c)/(b*x^3 + a)^2, x)
```

### 3.105.9 Mupad [F(-1)]

Timed out.

$$\int \frac{\sin(c+dx)}{(a+bx^3)^2}\,dx = \int \frac{\sin(c+d\,x)}{(b\,x^3+a)^2}\,dx$$

input
```
int(sin(c + d*x)/(a + b*x^3)^2,x)
```

output
```
int(sin(c + d*x)/(a + b*x^3)^2, x)
```

# 3.106 $\int \frac{\sin(c+dx)}{x(a+bx^3)^2} \, dx$

### 3.106.1 Optimal result

Integrand size = 19, antiderivative size = 693

$$\int \frac{\sin(c+dx)}{x(a+bx^3)^2}\,dx = \frac{\sqrt[3]{-1}d\cos\left(c+\frac{\sqrt[3]{-1}\sqrt[3]{a}d}{\sqrt[3]{b}}\right)\text{CosIntegral}\left(\frac{\sqrt[3]{-1}\sqrt[3]{a}d}{\sqrt[3]{b}}-dx\right)}{9a^{5/3}\sqrt[3]{b}}$$
$$-\frac{d\cos\left(c-\frac{\sqrt[3]{a}d}{\sqrt[3]{b}}\right)\text{CosIntegral}\left(\frac{\sqrt[3]{a}d}{\sqrt[3]{b}}+dx\right)}{9a^{5/3}\sqrt[3]{b}}$$
$$-\frac{(-1)^{2/3}d\cos\left(c-\frac{(-1)^{2/3}\sqrt[3]{a}d}{\sqrt[3]{b}}\right)\text{CosIntegral}\left(\frac{(-1)^{2/3}\sqrt[3]{a}d}{\sqrt[3]{b}}+dx\right)}{9a^{5/3}\sqrt[3]{b}}$$
$$+\frac{\text{CosIntegral}(dx)\sin(c)}{a^2}-\frac{\text{CosIntegral}\left(\frac{\sqrt[3]{a}d}{\sqrt[3]{b}}+dx\right)\sin\left(c-\frac{\sqrt[3]{a}d}{\sqrt[3]{b}}\right)}{3a^2}$$
$$-\frac{\text{CosIntegral}\left(\frac{\sqrt[3]{-1}\sqrt[3]{a}d}{\sqrt[3]{b}}-dx\right)\sin\left(c+\frac{\sqrt[3]{-1}\sqrt[3]{a}d}{\sqrt[3]{b}}\right)}{3a^2}$$
$$-\frac{\text{CosIntegral}\left(\frac{(-1)^{2/3}\sqrt[3]{a}d}{\sqrt[3]{b}}+dx\right)\sin\left(c-\frac{(-1)^{2/3}\sqrt[3]{a}d}{\sqrt[3]{b}}\right)}{3a^2}$$
$$+\frac{\sin(c+dx)}{3abx^3}-\frac{\sin(c+dx)}{3bx^3(a+bx^3)}+\frac{\cos(c)\text{Si}(dx)}{a^2}$$
$$+\frac{\cos\left(c+\frac{\sqrt[3]{-1}\sqrt[3]{a}d}{\sqrt[3]{b}}\right)\text{Si}\left(\frac{\sqrt[3]{-1}\sqrt[3]{a}d}{\sqrt[3]{b}}-dx\right)}{3a^2}$$
$$+\frac{\sqrt[3]{-1}d\sin\left(c+\frac{\sqrt[3]{-1}\sqrt[3]{a}d}{\sqrt[3]{b}}\right)\text{Si}\left(\frac{\sqrt[3]{-1}\sqrt[3]{a}d}{\sqrt[3]{b}}-dx\right)}{9a^{5/3}\sqrt[3]{b}}$$
$$-\frac{\cos\left(c-\frac{\sqrt[3]{a}d}{\sqrt[3]{b}}\right)\text{Si}\left(\frac{\sqrt[3]{a}d}{\sqrt[3]{b}}+dx\right)}{3a^2}+\frac{d\sin\left(c-\frac{\sqrt[3]{a}d}{\sqrt[3]{b}}\right)\text{Si}\left(\frac{\sqrt[3]{a}d}{\sqrt[3]{b}}+dx\right)}{9a^{5/3}\sqrt[3]{b}}$$
$$-\frac{\cos\left(c-\frac{(-1)^{2/3}\sqrt[3]{a}d}{\sqrt[3]{b}}\right)\text{Si}\left(\frac{(-1)^{2/3}\sqrt[3]{a}d}{\sqrt[3]{b}}+dx\right)}{3a^2}$$
$$+\frac{(-1)^{2/3}d\sin\left(c-\frac{(-1)^{2/3}\sqrt[3]{a}d}{\sqrt[3]{b}}\right)\text{Si}\left(\frac{(-1)^{2/3}\sqrt[3]{a}d}{\sqrt[3]{b}}+dx\right)}{9a^{5/3}\sqrt[3]{b}}$$

output
```
-1/9*d*Ci(a^(1/3)*d/b^(1/3)+d*x)*cos(c-a^(1/3)*d/b^(1/3))/a^(5/3)/b^(1/3)+
1/9*(-1)^(1/3)*d*Ci((-1)^(1/3)*a^(1/3)*d/b^(1/3)-d*x)*cos(c+(-1)^(1/3)*a^(
1/3)*d/b^(1/3))/a^(5/3)/b^(1/3)-1/9*(-1)^(2/3)*d*Ci((-1)^(2/3)*a^(1/3)*d/b
^(1/3)+d*x)*cos(c-(-1)^(2/3)*a^(1/3)*d/b^(1/3))/a^(5/3)/b^(1/3)+cos(c)*Si(
d*x)/a^2-1/3*cos(c+(-1)^(1/3)*a^(1/3)*d/b^(1/3))*Si(-(-1)^(1/3)*a^(1/3)*d/
b^(1/3)+d*x)/a^2-1/3*cos(c-a^(1/3)*d/b^(1/3))*Si(a^(1/3)*d/b^(1/3)+d*x)/a^
2-1/3*cos(c-(-1)^(2/3)*a^(1/3)*d/b^(1/3))*Si((-1)^(2/3)*a^(1/3)*d/b^(1/3)+
d*x)/a^2+Ci(d*x)*sin(c)/a^2-1/3*Ci(a^(1/3)*d/b^(1/3)+d*x)*sin(c-a^(1/3)*d/
b^(1/3))/a^2+1/9*d*Si(a^(1/3)*d/b^(1/3)+d*x)*sin(c-a^(1/3)*d/b^(1/3))/a^(5
/3)/b^(1/3)-1/3*Ci((-1)^(1/3)*a^(1/3)*d/b^(1/3)-d*x)*sin(c+(-1)^(1/3)*a^(1
/3)*d/b^(1/3))/a^2-1/9*(-1)^(1/3)*d*Si(-(-1)^(1/3)*a^(1/3)*d/b^(1/3)+d*x)*
sin(c+(-1)^(1/3)*a^(1/3)*d/b^(1/3))/a^(5/3)/b^(1/3)-1/3*Ci((-1)^(2/3)*a^(1
/3)*d/b^(1/3)+d*x)*sin(c-(-1)^(2/3)*a^(1/3)*d/b^(1/3))/a^2+1/9*(-1)^(2/3)*
d*Si((-1)^(2/3)*a^(1/3)*d/b^(1/3)+d*x)*sin(c-(-1)^(2/3)*a^(1/3)*d/b^(1/3))
/a^(5/3)/b^(1/3)+1/3*sin(d*x+c)/a/b/x^3-1/3*sin(d*x+c)/b/x^3/(b*x^3+a)
```

## 3.106.2 Mathematica [C] (verified)

Result contains higher order function than in optimal. Order 9 vs. order 4 in optimal.

Time = 0.40 (sec) , antiderivative size = 446, normalized size of antiderivative = 0.64

$$\int \frac{\sin(c+dx)}{x\,(a+bx^3)^2}\,dx$$

$$= \frac{-\frac{1}{2}i\text{RootSum}\left[a+b\#1^3\&,\cos(c+d\#1)\,\text{CosIntegral}(d(x-\#1))-i\,\text{CosIntegral}(d(x-\#1))\sin(c+d\#1\cdots}{\cdots}$$

input
```
Integrate[Sin[c + d*x]/(x*(a + b*x^3)^2),x]
```

output
```
((-1/2*I)*RootSum[a + b*#1^3 & , Cos[c + d*#1]*CosIntegral[d*(x - #1)] - I
*CosIntegral[d*(x - #1)]*Sin[c + d*#1] - I*Cos[c + d*#1]*SinIntegral[d*(x
- #1)] - Sin[c + d*#1]*SinIntegral[d*(x - #1)] & ] + (I/2)*RootSum[a + b*#
1^3 & , Cos[c + d*#1]*CosIntegral[d*(x - #1)] + I*CosIntegral[d*(x - #1)]*
Sin[c + d*#1] + I*Cos[c + d*#1]*SinIntegral[d*(x - #1)] - Sin[c + d*#1]*Si
nIntegral[d*(x - #1)] & ] - (a*d*RootSum[a + b*#1^3 & , (Cos[c + d*#1]*Cos
Integral[d*(x - #1)] - I*CosIntegral[d*(x - #1)]*Sin[c + d*#1] - I*Cos[c +
 d*#1]*SinIntegral[d*(x - #1)] - Sin[c + d*#1]*SinIntegral[d*(x - #1)])/#1
^2 & ])/(6*b) - (a*d*RootSum[a + b*#1^3 & , (Cos[c + d*#1]*CosIntegral[d*(
x - #1)] + I*CosIntegral[d*(x - #1)]*Sin[c + d*#1] + I*Cos[c + d*#1]*SinIn
tegral[d*(x - #1)] - Sin[c + d*#1]*SinIntegral[d*(x - #1)])/#1^2 & ])/(6*b
) + (a*Cos[d*x]*Sin[c])/(a + b*x^3) + 3*CosIntegral[d*x]*Sin[c] + (a*Cos[c
]*Sin[d*x])/(a + b*x^3) + 3*Cos[c]*SinIntegral[d*x])/(3*a^2)
```

### 3.106.3 Rubi [A] (verified)

Time = 2.01 (sec) , antiderivative size = 842, normalized size of antiderivative = 1.22, number of steps used = 5, number of rules used = 5, $\frac{\text{number of rules}}{\text{integrand size}} = 0.263$, Rules used = {3824, 3826, 2009, 3827, 2009}

Below are the steps used by Rubi to obtain the solution. The rule number used for the transformation is given above next to the arrow. The rules definitions used are listed below.

$$\int \frac{\sin(c+dx)}{x\left(a+bx^3\right)^2}dx$$

$$\Big\downarrow \ 3824$$

$$\frac{d\int \frac{\cos(c+dx)}{x^3(bx^3+a)}dx}{3b}-\frac{\int \frac{\sin(c+dx)}{x^4(bx^3+a)}dx}{b}-\frac{\sin(c+dx)}{3bx^3\left(a+bx^3\right)}$$

$$\Big\downarrow \ 3826$$

$$-\frac{\int \left(\frac{b^2\sin(c+dx)x^2}{a^2(bx^3+a)}-\frac{b\sin(c+dx)}{a^2x}+\frac{\sin(c+dx)}{ax^4}\right)dx}{b}+\frac{d\int \frac{\cos(c+dx)}{x^3(bx^3+a)}dx}{3b}-\frac{\sin(c+dx)}{3bx^3\left(a+bx^3\right)}$$

$$\Big\downarrow \ 2009$$

$$\frac{d\int \frac{\cos(c+dx)}{x^3(bx^3+a)}dx}{3b} - \frac{-\frac{b\sin(c)\,\text{CosIntegral}(dx)}{a^2} + \frac{b\sin\left(c-\frac{\sqrt[3]{a}d}{\sqrt[3]{b}}\right)\text{CosIntegral}\left(xd+\frac{\sqrt[3]{a}d}{\sqrt[3]{b}}\right)}{3a^2} + \frac{b\sin\left(\frac{\sqrt[3]{-1}\sqrt[3]{a}d}{\sqrt[3]{b}}+c\right)\text{CosIntegral}\left(\frac{\sqrt[3]{-1}\sqrt[3]{a}d}{\sqrt[3]{b}}-dx\right)}{3a^2} + \frac{b\sin\left(\right.}{}}{\frac{\sin(c+dx)}{3bx^3(a+bx^3)}}$$

$\downarrow$ 3827

$$\frac{d\int\left(\frac{\cos(c+dx)}{ax^3}-\frac{b\cos(c+dx)}{a(bx^3+a)}\right)dx}{3b} - \frac{-\frac{b\sin(c)\,\text{CosIntegral}(dx)}{a^2} + \frac{b\sin\left(c-\frac{\sqrt[3]{a}d}{\sqrt[3]{b}}\right)\text{CosIntegral}\left(xd+\frac{\sqrt[3]{a}d}{\sqrt[3]{b}}\right)}{3a^2} + \frac{b\sin\left(\frac{\sqrt[3]{-1}\sqrt[3]{a}d}{\sqrt[3]{b}}+c\right)\text{CosIntegral}\left(\frac{\sqrt[3]{-1}\sqrt[3]{a}d}{\sqrt[3]{b}}-dx\right)}{3a^2} + \frac{b\sin\left(\right.}{}}{\frac{\sin(c+dx)}{3bx^3(a+bx^3)}}$$

$\downarrow$ 2009

$$-\frac{\sin(c+dx)}{3bx^3(bx^3+a)} - \frac{-\frac{\cos(c)\,\text{CosIntegral}(dx)d^3}{6a}+\frac{\sin(c)\text{Si}(dx)d^3}{6a}+\frac{\sin(c+dx)d^2}{6ax}-\frac{\cos(c+dx)d}{6ax^2}-\frac{b\,\text{CosIntegral}(dx)\sin(c)}{a^2}+\frac{b\,\text{CosIntegral}\left(xd+\frac{\sqrt[3]{a}d}{\sqrt[3]{b}}\right)\sin\left(c\right.}{3a^2}}{d\left(-\frac{\cos(c)\,\text{CosIntegral}(dx)d^2}{2a}+\frac{\sin(c)\text{Si}(dx)d^2}{2a}+\frac{\sin(c+dx)d}{2ax}-\frac{\cos(c+dx)}{2ax^2}+\frac{\sqrt[3]{-1}b^{2/3}\cos\left(c+\frac{\sqrt[3]{-1}\sqrt[3]{a}d}{\sqrt[3]{b}}\right)\text{CosIntegral}\left(\frac{\sqrt[3]{-1}\sqrt[3]{a}}{\sqrt[3]{b}}\right.}{3a^{5/3}}\right.}$$

input
```
Int[Sin[c + d*x]/(x*(a + b*x^3)^2),x]
```

3.106. $\int \frac{\sin(c+dx)}{x(a+bx^3)^2}\,dx$

output
```
-1/3*Sin[c + d*x]/(b*x^3*(a + b*x^3)) - (-1/6*(d*Cos[c + d*x])/(a*x^2) - (
d^3*Cos[c]*CosIntegral[d*x])/(6*a) - (b*CosIntegral[d*x]*Sin[c])/a^2 + (b*
CosIntegral[(a^(1/3)*d)/b^(1/3) + d*x]*Sin[c - (a^(1/3)*d)/b^(1/3)])/(3*a^
2) + (b*CosIntegral[((-1)^(1/3)*a^(1/3)*d)/b^(1/3) - d*x]*Sin[c + ((-1)^(1
/3)*a^(1/3)*d)/b^(1/3)])/(3*a^2) + (b*CosIntegral[((-1)^(2/3)*a^(1/3)*d)/b
^(1/3) + d*x]*Sin[c - ((-1)^(2/3)*a^(1/3)*d)/b^(1/3)])/(3*a^2) - Sin[c + d
*x]/(3*a*x^3) + (d^2*Sin[c + d*x])/(6*a*x) - (b*Cos[c]*SinIntegral[d*x])/a
^2 + (d^3*Sin[c]*SinIntegral[d*x])/(6*a) - (b*Cos[c + ((-1)^(1/3)*a^(1/3)*
d)/b^(1/3)]*SinIntegral[((-1)^(1/3)*a^(1/3)*d)/b^(1/3) - d*x])/(3*a^2) + (
b*Cos[c - (a^(1/3)*d)/b^(1/3)]*SinIntegral[(a^(1/3)*d)/b^(1/3) + d*x])/(3*
a^2) + (b*Cos[c - ((-1)^(2/3)*a^(1/3)*d)/b^(1/3)]*SinIntegral[((-1)^(2/3)*
a^(1/3)*d)/b^(1/3) + d*x])/(3*a^2))/b + (d*(-1/2*Cos[c + d*x]/(a*x^2) - (d
^2*Cos[c]*CosIntegral[d*x])/(2*a) + ((-1)^(1/3)*b^(2/3)*Cos[c + ((-1)^(1/3
)*a^(1/3)*d)/b^(1/3)]*CosIntegral[((-1)^(1/3)*a^(1/3)*d)/b^(1/3) - d*x])/(
3*a^(5/3)) - (b^(2/3)*Cos[c - (a^(1/3)*d)/b^(1/3)]*CosIntegral[(a^(1/3)*d)
/b^(1/3) + d*x])/(3*a^(5/3)) - ((-1)^(2/3)*b^(2/3)*Cos[c - ((-1)^(2/3)*a^(
1/3)*d)/b^(1/3)]*CosIntegral[((-1)^(2/3)*a^(1/3)*d)/b^(1/3) + d*x])/(3*a^(
5/3)) + (d*Sin[c + d*x])/(2*a*x) + (d^2*Sin[c]*SinIntegral[d*x])/(2*a) + (
(-1)^(1/3)*b^(2/3)*Sin[c + ((-1)^(1/3)*a^(1/3)*d)/b^(1/3)]*SinIntegral[((-
1)^(1/3)*a^(1/3)*d)/b^(1/3) - d*x])/(3*a^(5/3)) + (b^(2/3)*Sin[c - (a^(...
```

### 3.106.3.1 Defintions of rubi rules used

rule 2009
```
Int[u_, x_Symbol] :> Simp[IntSum[u, x], x] /; SumQ[u]
```

rule 3824
```
Int[(x_)^(m_.)*((a_) + (b_.)*(x_)^(n_))^(p_)*Sin[(c_.) + (d_.)*(x_)], x_Sym
bol] :> Simp[x^(m - n + 1)*(a + b*x^n)^(p + 1)*(Sin[c + d*x]/(b*n*(p + 1)))
, x] + (-Simp[(m - n + 1)/(b*n*(p + 1))   Int[x^(m - n)*(a + b*x^n)^(p + 1)
*Sin[c + d*x], x], x] - Simp[d/(b*n*(p + 1))   Int[x^(m - n + 1)*(a + b*x^n
)^(p + 1)*Cos[c + d*x], x], x]) /; FreeQ[{a, b, c, d, m}, x] && ILtQ[p, -1]
 && IGtQ[n, 0] && (GtQ[m - n + 1, 0] || GtQ[n, 2]) && RationalQ[m]
```

rule 3826
```
Int[(x_)^(m_.)*((a_) + (b_.)*(x_)^(n_))^(p_)*Sin[(c_.) + (d_.)*(x_)], x_Sym
bol] :> Int[ExpandIntegrand[Sin[c + d*x], x^m*(a + b*x^n)^p, x], x] /; Free
Q[{a, b, c, d, m}, x] && ILtQ[p, 0] && IGtQ[n, 0] && (EqQ[n, 2] || EqQ[p, -
1]) && IntegerQ[m]
```

rule 3827
```
Int[Cos[(c_.) + (d_.)*(x_)]*(x_)^(m_.)*((a_) + (b_.)*(x_)^(n_))^(p_), x_Sym
bol] :> Int[ExpandIntegrand[Cos[c + d*x], x^m*(a + b*x^n)^p, x], x] /; Free
Q[{a, b, c, d, m}, x] && ILtQ[p, 0] && IGtQ[n, 0] && (EqQ[n, 2] || EqQ[p, -
1]) && IntegerQ[m]
```

## 3.106.4 Maple [C] (verified)

Result contains higher order function than in optimal. Order 9 vs. order 4.

Time = 0.51 (sec) , antiderivative size = 233, normalized size of antiderivative = 0.34

| method | result |
|---|---|
| derivativedivides | $\frac{\sin(dx+c)d^3}{3a\left(a\,d^3-c^3b+3b\,c^2(dx+c)-3bc(dx+c)^2+b(dx+c)^3\right)}-\frac{\sum_{\_R1=\mathrm{RootOf}\left(b\_Z^3-3\_Z^2bc+3c^2b\_Z+a\,d^3-c^3b\right)}\left(-\mathrm{Si}\left(-dx+\cdots\right.\right.}{3a^2\cdots}$ |
| default | $\frac{\sin(dx+c)d^3}{3a\left(a\,d^3-c^3b+3b\,c^2(dx+c)-3bc(dx+c)^2+b(dx+c)^3\right)}-\frac{\sum_{\_R1=\mathrm{RootOf}\left(b\_Z^3-3\_Z^2bc+3c^2b\_Z+a\,d^3-c^3b\right)}\left(-\mathrm{Si}\left(-dx+\cdots\right.\right.}{3a^2\cdots}$ |
| risch | $-\frac{i\left(\sum_{\_R1=\mathrm{RootOf}\left(-3i\_Z^2bc-id^3a+ib\,c^3+b\_Z^3-3c^2b\_Z\right)}\frac{\left(-id^3a-6i\_R1bc+3b\_R1^2-3c^2b\right)e^{\_R1}\,\mathrm{Ei}_1\left(-idx-ic+\_\cdots\right.}{-2ic\_R1+\_R1^2-c^2}\right.}{18a^2b}$ |

input
```
int(sin(d*x+c)/x/(b*x^3+a)^2,x,method=_RETURNVERBOSE)
```

output
```
1/3*sin(d*x+c)*d^3/a/(a*d^3-c^3*b+3*b*c^2*(d*x+c)-3*b*c*(d*x+c)^2+b*(d*x+c
)^3)-1/3/a^2*sum(-Si(-d*x+_R1-c)*cos(_R1)+Ci(d*x-_R1+c)*sin(_R1),_R1=RootO
f(_Z^3*b-3*_Z^2*b*c+3*_Z*b*c^2+a*d^3-b*c^3))+1/a^2*(Si(d*x)*cos(c)+Ci(d*x)
*sin(c))-1/9*d^3/a/b*sum(1/(_RR1^2-2*_RR1*c+c^2)*(Si(-d*x+_RR1-c)*sin(_RR1
)+Ci(d*x-_RR1+c)*cos(_RR1)),_RR1=RootOf(_Z^3*b-3*_Z^2*b*c+3*_Z*b*c^2+a*d^3
-b*c^3))
```

### 3.106.5 Fricas [C] (verification not implemented)

Result contains complex when optimal does not.

Time = 0.34 (sec) , antiderivative size = 576, normalized size of antiderivative = 0.83

$$\int \frac{\sin(c+dx)}{x(a+bx^3)^2}\,dx$$
$$= \frac{\left(-6i\,bx^3+\left(i\,bx^3-\sqrt{3}(bx^3+a)+i\,a\right)\left(\frac{i\,ad^3}{b}\right)^{\frac{1}{3}}-6i\,a\right)\mathrm{Ei}\left(-i\,dx+\frac{1}{2}\left(\frac{i\,ad^3}{b}\right)^{\frac{1}{3}}\left(-i\sqrt{3}-1\right)\right)e^{\left(\frac{1}{2}\left(\frac{i\,ad^3}{b}\right)^{\frac{1}{3}}\right.}}{}$$

input
```
integrate(sin(d*x+c)/x/(b*x^3+a)^2,x, algorithm="fricas")
```

output
```
1/36*((-6*I*b*x^3 + (I*b*x^3 - sqrt(3)*(b*x^3 + a) + I*a)*(I*a*d^3/b)^(1/3
) - 6*I*a)*Ei(-I*d*x + 1/2*(I*a*d^3/b)^(1/3)*(-I*sqrt(3) - 1))*e^(1/2*(I*a
*d^3/b)^(1/3)*(I*sqrt(3) + 1) - I*c) + (6*I*b*x^3 + (-I*b*x^3 + sqrt(3)*(b
*x^3 + a) - I*a)*(-I*a*d^3/b)^(1/3) + 6*I*a)*Ei(I*d*x + 1/2*(-I*a*d^3/b)^(
1/3)*(-I*sqrt(3) - 1))*e^(1/2*(-I*a*d^3/b)^(1/3)*(I*sqrt(3) + 1) + I*c) +
(-6*I*b*x^3 + (I*b*x^3 + sqrt(3)*(b*x^3 + a) + I*a)*(I*a*d^3/b)^(1/3) - 6*
I*a)*Ei(-I*d*x + 1/2*(I*a*d^3/b)^(1/3)*(I*sqrt(3) - 1))*e^(1/2*(I*a*d^3/b)
^(1/3)*(-I*sqrt(3) + 1) - I*c) + (6*I*b*x^3 + (-I*b*x^3 - sqrt(3)*(b*x^3 +
 a) - I*a)*(-I*a*d^3/b)^(1/3) + 6*I*a)*Ei(I*d*x + 1/2*(-I*a*d^3/b)^(1/3)*(
I*sqrt(3) - 1))*e^(1/2*(-I*a*d^3/b)^(1/3)*(-I*sqrt(3) + 1) + I*c) - 2*(-3*
I*b*x^3 + (-I*b*x^3 - I*a)*(-I*a*d^3/b)^(1/3) - 3*I*a)*Ei(I*d*x + (-I*a*d^
3/b)^(1/3))*e^(I*c - (-I*a*d^3/b)^(1/3)) - 2*(3*I*b*x^3 + (I*b*x^3 + I*a)*
(I*a*d^3/b)^(1/3) + 3*I*a)*Ei(-I*d*x + (I*a*d^3/b)^(1/3))*e^(-I*c - (I*a*d
^3/b)^(1/3)) + 36*(b*x^3 + a)*cos_integral(d*x)*sin(c) + 36*(b*x^3 + a)*co
s(c)*sin_integral(d*x) + 12*a*sin(d*x + c))/(a^2*b*x^3 + a^3)
```

### 3.106.6 Sympy [F]

$$\int \frac{\sin(c+dx)}{x(a+bx^3)^2}\,dx = \int \frac{\sin(c+dx)}{x(a+bx^3)^2}\,dx$$

input
```
integrate(sin(d*x+c)/x/(b*x**3+a)**2,x)
```

output
```
Integral(sin(c + d*x)/(x*(a + b*x**3)**2), x)
```

### 3.106.7 Maxima [F]

$$\int \frac{\sin(c+dx)}{x\left(a+bx^3\right)^2}\,dx = \int \frac{\sin\left(dx+c\right)}{\left(bx^3+a\right)^2 x}\,dx$$

input
```
integrate(sin(d*x+c)/x/(b*x^3+a)^2,x, algorithm="maxima")
```

output
```
integrate(sin(d*x + c)/((b*x^3 + a)^2*x), x)
```

### 3.106.8 Giac [F]

$$\int \frac{\sin(c+dx)}{x\left(a+bx^3\right)^2}\,dx = \int \frac{\sin\left(dx+c\right)}{\left(bx^3+a\right)^2 x}\,dx$$

input
```
integrate(sin(d*x+c)/x/(b*x^3+a)^2,x, algorithm="giac")
```

output
```
integrate(sin(d*x + c)/((b*x^3 + a)^2*x), x)
```

### 3.106.9 Mupad [F(-1)]

Timed out.

$$\int \frac{\sin(c+dx)}{x\left(a+bx^3\right)^2}\,dx = \int \frac{\sin\left(c+d\,x\right)}{x\,\left(b\,x^3+a\right)^2}\,dx$$

input
```
int(sin(c + d*x)/(x*(a + b*x^3)^2),x)
```

output
```
int(sin(c + d*x)/(x*(a + b*x^3)^2), x)
```

# 3.107 $\int \frac{\sin(c+dx)}{x^2\left(a+bx^3\right)^2}\,dx$

### 3.107.1 Optimal result

Integrand size = 19, antiderivative size = 712

$$\int \frac{\sin(c+dx)}{x^2(a+bx^3)^2}\,dx = \frac{d\cos(c)\,\text{CosIntegral}(dx)}{a^2} + \frac{d\cos\left(c+\frac{\sqrt[3]{-1}\sqrt[3]{a}d}{\sqrt[3]{b}}\right)\text{CosIntegral}\left(\frac{\sqrt[3]{-1}\sqrt[3]{a}d}{\sqrt[3]{b}}-dx\right)}{9a^2} + \frac{d\cos\left(c-\frac{\sqrt[3]{a}d}{\sqrt[3]{b}}\right)\text{CosIntegral}\left(\frac{\sqrt[3]{a}d}{\sqrt[3]{b}}+dx\right)}{9a^2} + \frac{d\cos\left(c-\frac{(-1)^{2/3}\sqrt[3]{a}d}{\sqrt[3]{b}}\right)\text{CosIntegral}\left(\frac{(-1)^{2/3}\sqrt[3]{a}d}{\sqrt[3]{b}}+dx\right)}{9a^2} + \frac{4\sqrt[3]{b}\,\text{CosIntegral}\left(\frac{\sqrt[3]{a}d}{\sqrt[3]{b}}+dx\right)\sin\left(c-\frac{\sqrt[3]{a}d}{\sqrt[3]{b}}\right)}{9a^{7/3}} + \frac{4(-1)^{2/3}\sqrt[3]{b}\,\text{CosIntegral}\left(\frac{\sqrt[3]{-1}\sqrt[3]{a}d}{\sqrt[3]{b}}-dx\right)\sin\left(c+\frac{\sqrt[3]{-1}\sqrt[3]{a}d}{\sqrt[3]{b}}\right)}{9a^{7/3}} - \frac{4\sqrt[3]{-1}\sqrt[3]{b}\,\text{CosIntegral}\left(\frac{(-1)^{2/3}\sqrt[3]{a}d}{\sqrt[3]{b}}+dx\right)\sin\left(c-\frac{(-1)^{2/3}\sqrt[3]{a}d}{\sqrt[3]{b}}\right)}{9a^{7/3}} + \frac{\sin(c+dx)}{3abx^4} - \frac{4\sin(c+dx)}{3a^2x} - \frac{\sin(c+dx)}{3bx^4(a+bx^3)} - \frac{d\sin(c)\text{Si}(dx)}{a^2} - \frac{4(-1)^{2/3}\sqrt[3]{b}\cos\left(c+\frac{\sqrt[3]{-1}\sqrt[3]{a}d}{\sqrt[3]{b}}\right)\text{Si}\left(\frac{\sqrt[3]{-1}\sqrt[3]{a}d}{\sqrt[3]{b}}-dx\right)}{9a^{7/3}} + \frac{d\sin\left(c+\frac{\sqrt[3]{-1}\sqrt[3]{a}d}{\sqrt[3]{b}}\right)\text{Si}\left(\frac{\sqrt[3]{-1}\sqrt[3]{a}d}{\sqrt[3]{b}}-dx\right)}{9a^2} + \frac{4\sqrt[3]{b}\cos\left(c-\frac{\sqrt[3]{a}d}{\sqrt[3]{b}}\right)\text{Si}\left(\frac{\sqrt[3]{a}d}{\sqrt[3]{b}}+dx\right)}{9a^{7/3}} - \frac{d\sin\left(c-\frac{\sqrt[3]{a}d}{\sqrt[3]{b}}\right)\text{Si}\left(\frac{\sqrt[3]{a}d}{\sqrt[3]{b}}+dx\right)}{9a^2} - \frac{4\sqrt[3]{-1}\sqrt[3]{b}\cos\left(c-\frac{(-1)^{2/3}\sqrt[3]{a}d}{\sqrt[3]{b}}\right)\text{Si}\left(\frac{(-1)^{2/3}\sqrt[3]{a}d}{\sqrt[3]{b}}+dx\right)}{9a^{7/3}} - \frac{d\sin\left(c-\frac{(-1)^{2/3}\sqrt[3]{a}d}{\sqrt[3]{b}}\right)\text{Si}\left(\frac{(-1)^{2/3}\sqrt[3]{a}d}{\sqrt[3]{b}}+dx\right)}{9a^2}$$

output
```
d*Ci(d*x)*cos(c)/a^2+1/9*d*Ci(a^(1/3)*d/b^(1/3)+d*x)*cos(c-a^(1/3)*d/b^(1/
3))/a^2+1/9*d*Ci((-1)^(1/3)*a^(1/3)*d/b^(1/3)-d*x)*cos(c+(-1)^(1/3)*a^(1/3
)*d/b^(1/3))/a^2+1/9*d*Ci((-1)^(2/3)*a^(1/3)*d/b^(1/3)+d*x)*cos(c-(-1)^(2/
3)*a^(1/3)*d/b^(1/3))/a^2+4/9*(-1)^(2/3)*b^(1/3)*cos(c+(-1)^(1/3)*a^(1/3)*
d/b^(1/3))*Si(-(-1)^(1/3)*a^(1/3)*d/b^(1/3)+d*x)/a^(7/3)+4/9*b^(1/3)*cos(c
-a^(1/3)*d/b^(1/3))*Si(a^(1/3)*d/b^(1/3)+d*x)/a^(7/3)-4/9*(-1)^(1/3)*b^(1/
3)*cos(c-(-1)^(2/3)*a^(1/3)*d/b^(1/3))*Si((-1)^(2/3)*a^(1/3)*d/b^(1/3)+d*x
)/a^(7/3)-d*Si(d*x)*sin(c)/a^2+4/9*b^(1/3)*Ci(a^(1/3)*d/b^(1/3)+d*x)*sin(c
-a^(1/3)*d/b^(1/3))/a^(7/3)-1/9*d*Si(a^(1/3)*d/b^(1/3)+d*x)*sin(c-a^(1/3)*
d/b^(1/3))/a^2+4/9*(-1)^(2/3)*b^(1/3)*Ci((-1)^(1/3)*a^(1/3)*d/b^(1/3)-d*x)
*sin(c+(-1)^(1/3)*a^(1/3)*d/b^(1/3))/a^(7/3)-1/9*d*Si(-(-1)^(1/3)*a^(1/3)*
d/b^(1/3)+d*x)*sin(c+(-1)^(1/3)*a^(1/3)*d/b^(1/3))/a^2-4/9*(-1)^(1/3)*b^(1
/3)*Ci((-1)^(2/3)*a^(1/3)*d/b^(1/3)+d*x)*sin(c-(-1)^(2/3)*a^(1/3)*d/b^(1/3
))/a^(7/3)-1/9*d*Si((-1)^(2/3)*a^(1/3)*d/b^(1/3)+d*x)*sin(c-(-1)^(2/3)*a^(
1/3)*d/b^(1/3))/a^2+1/3*sin(d*x+c)/a/b/x^4-4/3*sin(d*x+c)/a^2/x-1/3*sin(d*
x+c)/b/x^4/(b*x^3+a)
```

### 3.107.2 Mathematica [C] (verified)

Result contains higher order function than in optimal. Order 9 vs. order 4 in optimal.

Time = 0.54 (sec) , antiderivative size = 445, normalized size of antiderivative = 0.62

$$\int \frac{\sin(c+dx)}{x^2(a+bx^3)^2}\,dx =$$
$$-\frac{(3a+4bx^3)\cos(dx)\sin(c)+(3a+4bx^3)\cos(c)\sin(dx)-\frac{1}{6}x(a+bx^3)\left(18d\cos(c)\,\mathrm{CosIntegral}(dx)+\mathrm{R}\right.}{}$$

input
```
Integrate[Sin[c + d*x]/(x^2*(a + b*x^3)^2),x]
```

output
```
-1/3*((3*a + 4*b*x^3)*Cos[d*x]*Sin[c] + (3*a + 4*b*x^3)*Cos[c]*Sin[d*x] -
(x*(a + b*x^3)*(18*d*Cos[c]*CosIntegral[d*x] + RootSum[a + b*#1^3 & , ((-4
*I)*Cos[c + d*#1]*CosIntegral[d*(x - #1)] - 4*CosIntegral[d*(x - #1)]*Sin[
c + d*#1] - 4*Cos[c + d*#1]*SinIntegral[d*(x - #1)] + (4*I)*Sin[c + d*#1]*
SinIntegral[d*(x - #1)] + d*Cos[c + d*#1]*CosIntegral[d*(x - #1)]*#1 - I*d
*CosIntegral[d*(x - #1)]*Sin[c + d*#1]*#1 - I*d*Cos[c + d*#1]*SinIntegral[
d*(x - #1)]*#1 - d*Sin[c + d*#1]*SinIntegral[d*(x - #1)]*#1)/#1 & ] + Root
Sum[a + b*#1^3 & , ((4*I)*Cos[c + d*#1]*CosIntegral[d*(x - #1)] - 4*CosInt
egral[d*(x - #1)]*Sin[c + d*#1] - 4*Cos[c + d*#1]*SinIntegral[d*(x - #1)]
- (4*I)*Sin[c + d*#1]*SinIntegral[d*(x - #1)] + d*Cos[c + d*#1]*CosIntegra
l[d*(x - #1)]*#1 + I*d*CosIntegral[d*(x - #1)]*Sin[c + d*#1]*#1 + I*d*Cos[
c + d*#1]*SinIntegral[d*(x - #1)]*#1 - d*Sin[c + d*#1]*SinIntegral[d*(x -
#1)]*#1)/#1 & ] - 18*d*Sin[c]*SinIntegral[d*x]))/6)/(a^2*x*(a + b*x^3))
```

### 3.107.3 Rubi [A] (verified)

Time = 2.14 (sec) , antiderivative size = 920, normalized size of antiderivative = 1.29, number of steps used = 5, number of rules used = 5, $\frac{\text{number of rules}}{\text{integrand size}} = 0.263$, Rules used = {3824, 3826, 2009, 3827, 2009}

Below are the steps used by Rubi to obtain the solution. The rule number used for the transformation is given above next to the arrow. The rules definitions used are listed below.

$$\int \frac{\sin(c+dx)}{x^2 (a+bx^3)^2} \, dx$$

$$\Big\downarrow \ 3824$$

$$-\frac{4\int \frac{\sin(c+dx)}{x^5(bx^3+a)}dx}{3b}+\frac{d\int \frac{\cos(c+dx)}{x^4(bx^3+a)}dx}{3b}-\frac{\sin(c+dx)}{3bx^4(a+bx^3)}$$

$$\Big\downarrow \ 3826$$

$$-\frac{4\int \left(\frac{x\sin(c+dx)b^2}{a^2(bx^3+a)}-\frac{\sin(c+dx)b}{a^2x^2}+\frac{\sin(c+dx)}{ax^5}\right)dx}{3b}+\frac{d\int \frac{\cos(c+dx)}{x^4(bx^3+a)}dx}{3b}-\frac{\sin(c+dx)}{3bx^4(a+bx^3)}$$

$$\Big\downarrow \ 2009$$

$$\frac{d\int \frac{\cos(c+dx)}{x^4(bx^3+a)}dx}{3b} - \frac{4\left(-\frac{b^{4/3}\sin\left(c-\frac{\sqrt[3]{a}d}{\sqrt[3]{b}}\right)\text{CosIntegral}\left(xd+\frac{\sqrt[3]{a}d}{\sqrt[3]{b}}\right)}{3a^{7/3}} - \frac{(-1)^{2/3}b^{4/3}\sin\left(\frac{\sqrt[3]{-1}\sqrt[3]{a}d}{\sqrt[3]{b}}+c\right)\text{CosIntegral}\left(\frac{\sqrt[3]{-1}\sqrt[3]{a}d}{\sqrt[3]{b}}-dx\right)}{3a^{7/3}} + \frac{\sqrt[3]{-1}b^{4/3}\sin\left(\right.}{}\right.}{}$$

$$\frac{\sin(c+dx)}{3bx^4(a+bx^3)}$$

$$\Big\downarrow \text{3827}$$

$$\frac{d\int\left(\frac{b^2\cos(c+dx)x^2}{a^2(bx^3+a)} - \frac{b\cos(c+dx)}{a^2x} + \frac{\cos(c+dx)}{ax^4}\right)dx}{3b} - \frac{4\left(-\frac{b^{4/3}\sin\left(c-\frac{\sqrt[3]{a}d}{\sqrt[3]{b}}\right)\text{CosIntegral}\left(xd+\frac{\sqrt[3]{a}d}{\sqrt[3]{b}}\right)}{3a^{7/3}} - \frac{(-1)^{2/3}b^{4/3}\sin\left(\frac{\sqrt[3]{-1}\sqrt[3]{a}d}{\sqrt[3]{b}}+c\right)\text{CosIntegral}\left(\frac{\sqrt[3]{-1}\sqrt[3]{a}d}{\sqrt[3]{b}}-dx\right)}{3a^{7/3}} + \frac{\sqrt[3]{-1}b^{4/3}\sin\left(\right.}{}\right.}{}$$

$$\frac{\sin(c+dx)}{3bx^4(a+bx^3)}$$

$$\Big\downarrow \text{2009}$$

$$-\frac{\sin(c+dx)}{3bx^4(bx^3+a)} - \frac{4\left(\frac{\text{CosIntegral}(dx)\sin(c)d^4}{24a} + \frac{\cos(c)\text{Si}(dx)d^4}{24a} + \frac{\cos(c+dx)d^3}{24ax} + \frac{\sin(c+dx)d^2}{24ax^2} - \frac{\cos(c+dx)d}{12ax^3} - \frac{b\cos(c)\text{CosIntegral}(dx)d}{a^2} + \frac{b\sin(c)\text{Si}(dx)}{a^2}\right.}{}$$

$$\frac{d\left(\frac{\text{CosIntegral}(dx)\sin(c)d^3}{6a} + \frac{\cos(c)\text{Si}(dx)d^3}{6a} + \frac{\cos(c+dx)d^2}{6ax} + \frac{\sin(c+dx)d}{6ax^2} - \frac{\cos(c+dx)}{3ax^3} - \frac{b\cos(c)\text{CosIntegral}(dx)}{a^2} + \frac{b\cos\left(c+\frac{\sqrt[3]{-1}}{\sqrt[3]{}}\right.}{}\right.}{}$$

input
```
Int[Sin[c + d*x]/(x^2*(a + b*x^3)^2),x]
```

3.107. $\int \frac{\sin(c+dx)}{x^2(a+bx^3)^2}\,dx$

output
```
-1/3*Sin[c + d*x]/(b*x^4*(a + b*x^3)) - (4*(-1/12*(d*Cos[c + d*x])/(a*x^3)
 + (d^3*Cos[c + d*x])/(24*a*x) - (b*d*Cos[c]*CosIntegral[d*x])/a^2 + (d^4*
CosIntegral[d*x]*Sin[c])/(24*a) - (b^(4/3)*CosIntegral[(a^(1/3)*d)/b^(1/3)
 + d*x]*Sin[c - (a^(1/3)*d)/b^(1/3)])/(3*a^(7/3)) - ((-1)^(2/3)*b^(4/3)*Co
sIntegral[((-1)^(1/3)*a^(1/3)*d)/b^(1/3) - d*x]*Sin[c + ((-1)^(1/3)*a^(1/3
)*d)/b^(1/3)])/(3*a^(7/3)) + ((-1)^(1/3)*b^(4/3)*CosIntegral[((-1)^(2/3)*a
^(1/3)*d)/b^(1/3) + d*x]*Sin[c - ((-1)^(2/3)*a^(1/3)*d)/b^(1/3)])/(3*a^(7/
3)) - Sin[c + d*x]/(4*a*x^4) + (d^2*Sin[c + d*x])/(24*a*x^2) + (b*Sin[c +
d*x])/(a^2*x) + (d^4*Cos[c]*SinIntegral[d*x])/(24*a) + (b*d*Sin[c]*SinInte
gral[d*x])/a^2 + ((-1)^(2/3)*b^(4/3)*Cos[c + ((-1)^(1/3)*a^(1/3)*d)/b^(1/3
)]*SinIntegral[((-1)^(1/3)*a^(1/3)*d)/b^(1/3) - d*x])/(3*a^(7/3)) - (b^(4/
3)*Cos[c - (a^(1/3)*d)/b^(1/3)]*SinIntegral[(a^(1/3)*d)/b^(1/3) + d*x])/(3
*a^(7/3)) + ((-1)^(1/3)*b^(4/3)*Cos[c - ((-1)^(2/3)*a^(1/3)*d)/b^(1/3)]*Si
nIntegral[((-1)^(2/3)*a^(1/3)*d)/b^(1/3) + d*x])/(3*a^(7/3))))/(3*b) + (d*
(-1/3*Cos[c + d*x]/(a*x^3) + (d^2*Cos[c + d*x])/(6*a*x) - (b*Cos[c]*CosInt
egral[d*x])/a^2 + (b*Cos[c + ((-1)^(1/3)*a^(1/3)*d)/b^(1/3)]*CosIntegral[(
(-1)^(1/3)*a^(1/3)*d)/b^(1/3) - d*x])/(3*a^2) + (b*Cos[c - (a^(1/3)*d)/b^(
1/3)]*CosIntegral[(a^(1/3)*d)/b^(1/3) + d*x])/(3*a^2) + (b*Cos[c - ((-1)^(
2/3)*a^(1/3)*d)/b^(1/3)]*CosIntegral[((-1)^(2/3)*a^(1/3)*d)/b^(1/3) + d*x]
)/(3*a^2) + (d^3*CosIntegral[d*x]*Sin[c])/(6*a) + (d*Sin[c + d*x])/(6*a...
```

### 3.107.3.1 Defintions of rubi rules used

rule 2009
```
Int[u_, x_Symbol] :> Simp[IntSum[u, x], x] /; SumQ[u]
```

rule 3824
```
Int[(x_)^(m_.)*((a_) + (b_.)*(x_)^(n_))^(p_)*Sin[(c_.) + (d_.)*(x_)], x_Sym
bol] :> Simp[x^(m - n + 1)*(a + b*x^n)^(p + 1)*(Sin[c + d*x]/(b*n*(p + 1)))
, x] + (-Simp[(m - n + 1)/(b*n*(p + 1))   Int[x^(m - n)*(a + b*x^n)^(p + 1)
*Sin[c + d*x], x], x] - Simp[d/(b*n*(p + 1))   Int[x^(m - n + 1)*(a + b*x^n
)^(p + 1)*Cos[c + d*x], x], x]) /; FreeQ[{a, b, c, d, m}, x] && ILtQ[p, -1]
 && IGtQ[n, 0] && (GtQ[m - n + 1, 0] || GtQ[n, 2]) && RationalQ[m]
```

rule 3826
```
Int[(x_)^(m_.)*((a_) + (b_.)*(x_)^(n_))^(p_)*Sin[(c_.) + (d_.)*(x_)], x_Sym
bol] :> Int[ExpandIntegrand[Sin[c + d*x], x^m*(a + b*x^n)^p, x], x] /; Free
Q[{a, b, c, d, m}, x] && ILtQ[p, 0] && IGtQ[n, 0] && (EqQ[n, 2] || EqQ[p, -
1]) && IntegerQ[m]
```

rule 3827
```
Int[Cos[(c_.) + (d_.)*(x_)]*(x_)^(m_.)*((a_) + (b_.)*(x_)^(n_))^(p_), x_Sym
bol] :> Int[ExpandIntegrand[Cos[c + d*x], x^m*(a + b*x^n)^p, x], x] /; Free
Q[{a, b, c, d, m}, x] && ILtQ[p, 0] && IGtQ[n, 0] && (EqQ[n, 2] || EqQ[p, -
1]) && IntegerQ[m]
```

### 3.107.4 Maple [C] (verified)

Result contains higher order function than in optimal. Order 9 vs. order 4.

Time = 0.78 (sec) , antiderivative size = 284, normalized size of antiderivative = 0.40

| method | result |
|---|---|
| derivativedivides | $d\left(-\frac{\sin(dx+c)\left(\frac{4b(dx+c)^3}{3a^2}-\frac{4cb(dx+c)^2}{a^2}+\frac{4c^2b(dx+c)}{a^2}+\frac{3a\,d^3-4c^3b}{3a^2}\right)}{dx\left(a\,d^3-c^3b+3b\,c^2(dx+c)-3bc(dx+c)^2+b(dx+c)^3\right)}+\frac{4\left(\sum_{\_R1=\mathrm{RootOf}\left(b\_Z^3-3\_Z^2bc+3c^2b\_Z+a\,d^3 \right.}\right.}{}\right.$ |
| default | $d\left(-\frac{\sin(dx+c)\left(\frac{4b(dx+c)^3}{3a^2}-\frac{4cb(dx+c)^2}{a^2}+\frac{4c^2b(dx+c)}{a^2}+\frac{3a\,d^3-4c^3b}{3a^2}\right)}{dx\left(a\,d^3-c^3b+3b\,c^2(dx+c)-3bc(dx+c)^2+b(dx+c)^3\right)}+\frac{4\left(\sum_{\_R1=\mathrm{RootOf}\left(b\_Z^3-3\_Z^2bc+3c^2b\_Z+a\,d^3 \right.}\right.}{}\right.$ |
| risch | $-\frac{d\,\mathrm{Ei}_1(-idx)\mathrm{e}^{ic}}{2a^2}-\frac{d\left(\sum_{\_R1=\mathrm{RootOf}\left(-3i\_Z^2bc-id^3a+ibc^3+b\_Z^3-3c^2b\_Z\right)}\frac{\left(-ic+\_R1-4\right)\mathrm{e}^{-\_R1}\,\mathrm{Ei}_1\left(-idx-ic+\_R1\right.}{-ic+\_R1}\right.}{18a^2}$ |

input
```
int(sin(d*x+c)/x^2/(b*x^3+a)^2,x,method=_RETURNVERBOSE)
```

output
```
d*(-sin(d*x+c)*(4/3*b/a^2*(d*x+c)^3-4*c*b/a^2*(d*x+c)^2+4*c^2*b/a^2*(d*x+c
)+1/3*(3*a*d^3-4*b*c^3)/a^2)/d/x/(a*d^3-c^3*b+3*b*c^2*(d*x+c)-3*b*c*(d*x+c
)^2+b*(d*x+c)^3)+4/9/a^2*sum(1/(-_R1+c)*(-Si(-d*x+_R1-c)*cos(_R1)+Ci(d*x-_
R1+c)*sin(_R1)),_R1=RootOf(_Z^3*b-3*_Z^2*b*c+3*_Z*b*c^2+a*d^3-b*c^3))+1/9/
a^2*sum(Si(-d*x+_RR1-c)*sin(_RR1)+Ci(d*x-_RR1+c)*cos(_RR1),_RR1=RootOf(_Z^
3*b-3*_Z^2*b*c+3*_Z*b*c^2+a*d^3-b*c^3))+1/a^2*(-Si(d*x)*sin(c)+Ci(d*x)*cos
(c)))
```

### 3.107.5 Fricas [C] (verification not implemented)

Result contains complex when optimal does not.

Time = 0.36 (sec) , antiderivative size = 720, normalized size of antiderivative = 1.01

$$\int \frac{\sin(c+dx)}{x^2\left(a+bx^3\right)^2}\,dx$$

$$= \frac{18\left(abd^3x^4+a^2d^3x\right)\cos(c)\operatorname{Ci}(dx)+\left(abd^3x^4+a^2d^3x-2\left(-i\,b^2x^4-i\,abx-\sqrt{3}(b^2x^4+abx)\right)\left(\frac{i\,ad^3}{b}\right)^{\frac{2}{3}}\right)}{}$$

input
```
integrate(sin(d*x+c)/x^2/(b*x^3+a)^2,x, algorithm="fricas")
```

output
```
1/18*(18*(a*b*d^3*x^4 + a^2*d^3*x)*cos(c)*cos_integral(d*x) + (a*b*d^3*x^4
 + a^2*d^3*x - 2*(-I*b^2*x^4 - I*a*b*x - sqrt(3)*(b^2*x^4 + a*b*x))*(I*a*d
^3/b)^(2/3))*Ei(-I*d*x + 1/2*(I*a*d^3/b)^(1/3)*(-I*sqrt(3) - 1))*e^(1/2*(I
*a*d^3/b)^(1/3)*(I*sqrt(3) + 1) - I*c) + (a*b*d^3*x^4 + a^2*d^3*x - 2*(I*b
^2*x^4 + I*a*b*x + sqrt(3)*(b^2*x^4 + a*b*x))*(-I*a*d^3/b)^(2/3))*Ei(I*d*x
 + 1/2*(-I*a*d^3/b)^(1/3)*(-I*sqrt(3) - 1))*e^(1/2*(-I*a*d^3/b)^(1/3)*(I*s
qrt(3) + 1) + I*c) + (a*b*d^3*x^4 + a^2*d^3*x - 2*(-I*b^2*x^4 - I*a*b*x +
sqrt(3)*(b^2*x^4 + a*b*x))*(I*a*d^3/b)^(2/3))*Ei(-I*d*x + 1/2*(I*a*d^3/b)^
(1/3)*(I*sqrt(3) - 1))*e^(1/2*(I*a*d^3/b)^(1/3)*(-I*sqrt(3) + 1) - I*c) +
(a*b*d^3*x^4 + a^2*d^3*x - 2*(I*b^2*x^4 + I*a*b*x - sqrt(3)*(b^2*x^4 + a*b
*x))*(-I*a*d^3/b)^(2/3))*Ei(I*d*x + 1/2*(-I*a*d^3/b)^(1/3)*(I*sqrt(3) - 1)
)*e^(1/2*(-I*a*d^3/b)^(1/3)*(-I*sqrt(3) + 1) + I*c) + (a*b*d^3*x^4 + a^2*d
^3*x - 4*(-I*b^2*x^4 - I*a*b*x)*(-I*a*d^3/b)^(2/3))*Ei(I*d*x + (-I*a*d^3/b
)^(1/3))*e^(I*c - (-I*a*d^3/b)^(1/3)) + (a*b*d^3*x^4 + a^2*d^3*x - 4*(I*b^
2*x^4 + I*a*b*x)*(I*a*d^3/b)^(2/3))*Ei(-I*d*x + (I*a*d^3/b)^(1/3))*e^(-I*c
 - (I*a*d^3/b)^(1/3)) - 18*(a*b*d^3*x^4 + a^2*d^3*x)*sin(c)*sin_integral(d
*x) - 6*(4*a*b*d^2*x^3 + 3*a^2*d^2)*sin(d*x + c))/(a^3*b*d^2*x^4 + a^4*d^2
*x)
```

### 3.107.6 Sympy [F(-1)]

Timed out.

$$\int \frac{\sin(c+dx)}{x^2 (a+bx^3)^2} \, dx = \text{Timed out}$$

input
```
integrate(sin(d*x+c)/x**2/(b*x**3+a)**2,x)
```

output
```
Timed out
```

### 3.107.7 Maxima [F]

$$\int \frac{\sin(c+dx)}{x^2 (a+bx^3)^2} \, dx = \int \frac{\sin (dx+c)}{(bx^3+a)^2 x^2} \, dx$$

input
```
integrate(sin(d*x+c)/x^2/(b*x^3+a)^2,x, algorithm="maxima")
```

output
```
integrate(sin(d*x + c)/((b*x^3 + a)^2*x^2), x)
```

### 3.107.8 Giac [F]

$$\int \frac{\sin(c+dx)}{x^2 (a+bx^3)^2} \, dx = \int \frac{\sin (dx+c)}{(bx^3+a)^2 x^2} \, dx$$

input
```
integrate(sin(d*x+c)/x^2/(b*x^3+a)^2,x, algorithm="giac")
```

output
```
integrate(sin(d*x + c)/((b*x^3 + a)^2*x^2), x)
```

### 3.107.9 Mupad [F(-1)]

Timed out.

$$\int \frac{\sin(c+dx)}{x^2\left(a+bx^3\right)^2}\,dx = \int \frac{\sin\left(c+d\,x\right)}{x^2\,{\left(b\,x^3+a\right)}^2}\,dx$$

input
```
int(sin(c + d*x)/(x^2*(a + b*x^3)^2),x)
```

output
```
int(sin(c + d*x)/(x^2*(a + b*x^3)^2), x)
```

# 3.108 $\int \frac{\sin(c+dx)}{x^3(a+bx^3)^2} dx$

### 3.108.1 Optimal result

Integrand size = 19, antiderivative size = 800

$$
\begin{aligned}
\int \frac{\sin(c+dx)}{x^3\left(a+bx^3\right)^2}\,dx =& -\frac{d\cos(c+dx)}{2a^2x} \\
&-\frac{(-1)^{2/3}\sqrt[3]{b}d\cos\left(c+\frac{\sqrt[3]{-1}\sqrt[3]{a}d}{\sqrt[3]{b}}\right)\operatorname{CosIntegral}\left(\frac{\sqrt[3]{-1}\sqrt[3]{a}d}{\sqrt[3]{b}}-dx\right)}{9a^{7/3}} \\
&-\frac{\sqrt[3]{b}d\cos\left(c-\frac{\sqrt[3]{a}d}{\sqrt[3]{b}}\right)\operatorname{CosIntegral}\left(\frac{\sqrt[3]{a}d}{\sqrt[3]{b}}+dx\right)}{9a^{7/3}} \\
&+\frac{\sqrt[3]{-1}\sqrt[3]{b}d\cos\left(c-\frac{(-1)^{2/3}\sqrt[3]{a}d}{\sqrt[3]{b}}\right)\operatorname{CosIntegral}\left(\frac{(-1)^{2/3}\sqrt[3]{a}d}{\sqrt[3]{b}}+dx\right)}{9a^{7/3}} \\
&-\frac{d^2\operatorname{CosIntegral}(dx)\sin(c)}{2a^2} \\
&-\frac{5b^{2/3}\operatorname{CosIntegral}\left(\frac{\sqrt[3]{a}d}{\sqrt[3]{b}}+dx\right)\sin\left(c-\frac{\sqrt[3]{a}d}{\sqrt[3]{b}}\right)}{9a^{8/3}} \\
&+\frac{5\sqrt[3]{-1}b^{2/3}\operatorname{CosIntegral}\left(\frac{\sqrt[3]{-1}\sqrt[3]{a}d}{\sqrt[3]{b}}-dx\right)\sin\left(c+\frac{\sqrt[3]{-1}\sqrt[3]{a}d}{\sqrt[3]{b}}\right)}{9a^{8/3}} \\
&-\frac{5(-1)^{2/3}b^{2/3}\operatorname{CosIntegral}\left(\frac{(-1)^{2/3}\sqrt[3]{a}d}{\sqrt[3]{b}}+dx\right)\sin\left(c-\frac{(-1)^{2/3}\sqrt[3]{a}d}{\sqrt[3]{b}}\right)}{9a^{8/3}} \\
&+\frac{\sin(c+dx)}{3abx^5}-\frac{5\sin(c+dx)}{6a^2x^2}-\frac{\sin(c+dx)}{3bx^5\left(a+bx^3\right)}-\frac{d^2\cos(c)\operatorname{Si}(dx)}{2a^2} \\
&-\frac{5\sqrt[3]{-1}b^{2/3}\cos\left(c+\frac{\sqrt[3]{-1}\sqrt[3]{a}d}{\sqrt[3]{b}}\right)\operatorname{Si}\left(\frac{\sqrt[3]{-1}\sqrt[3]{a}d}{\sqrt[3]{b}}-dx\right)}{9a^{8/3}} \\
&-\frac{(-1)^{2/3}\sqrt[3]{b}d\sin\left(c+\frac{\sqrt[3]{-1}\sqrt[3]{a}d}{\sqrt[3]{b}}\right)\operatorname{Si}\left(\frac{\sqrt[3]{-1}\sqrt[3]{a}d}{\sqrt[3]{b}}-dx\right)}{9a^{7/3}} \\
&-\frac{5b^{2/3}\cos\left(c-\frac{\sqrt[3]{a}d}{\sqrt[3]{b}}\right)\operatorname{Si}\left(\frac{\sqrt[3]{a}d}{\sqrt[3]{b}}+dx\right)}{9a^{8/3}} \\
&+\frac{\sqrt[3]{b}d\sin\left(c-\frac{\sqrt[3]{a}d}{\sqrt[3]{b}}\right)\operatorname{Si}\left(\frac{\sqrt[3]{a}d}{\sqrt[3]{b}}+dx\right)}{9a^{7/3}} \\
&-\frac{5(-1)^{2/3}b^{2/3}\cos\left(c-\frac{(-1)^{2/3}\sqrt[3]{a}d}{\sqrt[3]{b}}\right)\operatorname{Si}\left(\frac{(-1)^{2/3}\sqrt[3]{a}d}{\sqrt[3]{b}}+dx\right)}{9a^{8/3}} \\
&-\frac{\sqrt[3]{-1}\sqrt[3]{b}d\sin\left(c-\frac{(-1)^{2/3}\sqrt[3]{a}d}{\sqrt[3]{b}}\right)\operatorname{Si}\left(\frac{(-1)^{2/3}\sqrt[3]{a}d}{\sqrt[3]{b}}+dx\right)}{9a^{7/3}}
\end{aligned}
$$

output
```
-1/9*b^(1/3)*d*Ci(a^(1/3)*d/b^(1/3)+d*x)*cos(c-a^(1/3)*d/b^(1/3))/a^(7/3)-
1/9*(-1)^(2/3)*b^(1/3)*d*Ci((-1)^(1/3)*a^(1/3)*d/b^(1/3)-d*x)*cos(c+(-1)^(
1/3)*a^(1/3)*d/b^(1/3))/a^(7/3)+1/9*(-1)^(1/3)*b^(1/3)*d*Ci((-1)^(2/3)*a^(
1/3)*d/b^(1/3)+d*x)*cos(c-(-1)^(2/3)*a^(1/3)*d/b^(1/3))/a^(7/3)-1/2*d*cos(
d*x+c)/a^2/x-1/2*d^2*cos(c)*Si(d*x)/a^2+5/9*(-1)^(1/3)*b^(2/3)*cos(c+(-1)^
(1/3)*a^(1/3)*d/b^(1/3))*Si(-(-1)^(1/3)*a^(1/3)*d/b^(1/3)+d*x)/a^(8/3)-5/9
*b^(2/3)*cos(c-a^(1/3)*d/b^(1/3))*Si(a^(1/3)*d/b^(1/3)+d*x)/a^(8/3)-5/9*(-
1)^(2/3)*b^(2/3)*cos(c-(-1)^(2/3)*a^(1/3)*d/b^(1/3))*Si((-1)^(2/3)*a^(1/3)
*d/b^(1/3)+d*x)/a^(8/3)-1/2*d^2*Ci(d*x)*sin(c)/a^2-5/9*b^(2/3)*Ci(a^(1/3)*
d/b^(1/3)+d*x)*sin(c-a^(1/3)*d/b^(1/3))/a^(8/3)+1/9*b^(1/3)*d*Si(a^(1/3)*d
/b^(1/3)+d*x)*sin(c-a^(1/3)*d/b^(1/3))/a^(7/3)+5/9*(-1)^(1/3)*b^(2/3)*Ci((
-1)^(1/3)*a^(1/3)*d/b^(1/3)-d*x)*sin(c+(-1)^(1/3)*a^(1/3)*d/b^(1/3))/a^(8/
3)+1/9*(-1)^(2/3)*b^(1/3)*d*Si(-(-1)^(1/3)*a^(1/3)*d/b^(1/3)+d*x)*sin(c+(-
1)^(1/3)*a^(1/3)*d/b^(1/3))/a^(7/3)-5/9*(-1)^(2/3)*b^(2/3)*Ci((-1)^(2/3)*a
^(1/3)*d/b^(1/3)+d*x)*sin(c-(-1)^(2/3)*a^(1/3)*d/b^(1/3))/a^(8/3)-1/9*(-1)
^(1/3)*b^(1/3)*d*Si((-1)^(2/3)*a^(1/3)*d/b^(1/3)+d*x)*sin(c-(-1)^(2/3)*a^(
1/3)*d/b^(1/3))/a^(7/3)+1/3*sin(d*x+c)/a/b/x^5-5/6*sin(d*x+c)/a^2/x^2-1/3*
sin(d*x+c)/b/x^5/(b*x^3+a)
```

### 3.108.2 Mathematica [C] (verified)

Result contains higher order function than in optimal. Order 9 vs. order 4 in optimal.

Time = 0.62 (sec) , antiderivative size = 470, normalized size of antiderivative = 0.59

$$\int \frac{\sin(c+dx)}{x^3\left(a+bx^3\right)^2}\,dx$$

$$= \frac{\text{RootSum}\left[a+b\#1^3\&,\frac{-5i\cos(c+d\#1)\,\text{CosIntegral}(d(x-\#1))-5\,\text{CosIntegral}(d(x-\#1))\sin(c+d\#1)-5\cos(c+d\#1)\text{Si}(d(x-\#1}{}\right.}{}$$

input
```
Integrate[Sin[c + d*x]/(x^3*(a + b*x^3)^2),x]
```

output
```
(RootSum[a + b*#1^3 & , ((-5*I)*Cos[c + d*#1]*CosIntegral[d*(x - #1)] - 5*
CosIntegral[d*(x - #1)]*Sin[c + d*#1] - 5*Cos[c + d*#1]*SinIntegral[d*(x -
 #1)] + (5*I)*Sin[c + d*#1]*SinIntegral[d*(x - #1)] + d*Cos[c + d*#1]*CosI
ntegral[d*(x - #1)]*#1 - I*d*CosIntegral[d*(x - #1)]*Sin[c + d*#1]*#1 - I*
d*Cos[c + d*#1]*SinIntegral[d*(x - #1)]*#1 - d*Sin[c + d*#1]*SinIntegral[d
*(x - #1)]*#1)/#1^2 & ] + RootSum[a + b*#1^3 & , ((5*I)*Cos[c + d*#1]*CosI
ntegral[d*(x - #1)] - 5*CosIntegral[d*(x - #1)]*Sin[c + d*#1] - 5*Cos[c +
d*#1]*SinIntegral[d*(x - #1)] - (5*I)*Sin[c + d*#1]*SinIntegral[d*(x - #1)
] + d*Cos[c + d*#1]*CosIntegral[d*(x - #1)]*#1 + I*d*CosIntegral[d*(x - #1
)]*Sin[c + d*#1]*#1 + I*d*Cos[c + d*#1]*SinIntegral[d*(x - #1)]*#1 - d*Sin
[c + d*#1]*SinIntegral[d*(x - #1)]*#1)/#1^2 & ] - (3*(3*a*d*x*Cos[c + d*x]
 + 3*b*d*x^4*Cos[c + d*x] + 3*d^2*x^2*(a + b*x^3)*CosIntegral[d*x]*Sin[c]
+ 3*a*Sin[c + d*x] + 5*b*x^3*Sin[c + d*x] + 3*d^2*x^2*(a + b*x^3)*Cos[c]*S
inIntegral[d*x]))/(x^2*(a + b*x^3)))/(18*a^2)
```

## 3.108.3 Rubi [A] (verified)

Time = 2.26 (sec) , antiderivative size = 1059, normalized size of antiderivative = 1.32, number of steps used = 5, number of rules used = 5, $\frac{\text{number of rules}}{\text{integrand size}} = 0.263$, Rules used = {3824, 3826, 2009, 3827, 2009}

Below are the steps used by Rubi to obtain the solution. The rule number used for the transformation is given above next to the arrow. The rules definitions used are listed below.

$$\int \frac{\sin(c+dx)}{x^3 (a+bx^3)^2} \, dx$$

$$\Big\downarrow \text{3824}$$

$$-\frac{5\int \frac{\sin(c+dx)}{x^6(bx^3+a)}dx}{3b}+\frac{d\int \frac{\cos(c+dx)}{x^5(bx^3+a)}dx}{3b}-\frac{\sin(c+dx)}{3bx^5(a+bx^3)}$$

$$\Big\downarrow \text{3826}$$

$$-\frac{5\int \left(\frac{\sin(c+dx)b^2}{a^2(bx^3+a)}-\frac{\sin(c+dx)b}{a^2x^3}+\frac{\sin(c+dx)}{ax^6}\right)dx}{3b}+\frac{d\int \frac{\cos(c+dx)}{x^5(bx^3+a)}dx}{3b}-\frac{\sin(c+dx)}{3bx^5(a+bx^3)}$$

$$\Big\downarrow \text{2009}$$

$$\frac{d\int \frac{\cos(c+dx)}{x^5(bx^3+a)}dx}{3b} - \frac{5\left(\frac{b^{5/3}\sin\left(c-\frac{\sqrt[3]{a}d}{\sqrt[3]{b}}\right)\text{CosIntegral}\left(xd+\frac{\sqrt[3]{a}d}{\sqrt[3]{b}}\right)}{3a^{8/3}} - \frac{\sqrt[3]{-1}b^{5/3}\sin\left(\frac{\sqrt[3]{-1}\sqrt[3]{a}d}{\sqrt[3]{b}}+c\right)\text{CosIntegral}\left(\frac{\sqrt[3]{-1}\sqrt[3]{a}d}{\sqrt[3]{b}}-dx\right)}{3a^{8/3}} + \frac{(-1)^{2/3}b^{5/3}\sin\left(c\right.}{}\right.}{}$$

$$\frac{\sin(c+dx)}{3bx^5(a+bx^3)}$$

$\downarrow$ 3827

$$\frac{d\int\left(\frac{x\cos(c+dx)b^2}{a^2(bx^3+a)} - \frac{\cos(c+dx)b}{a^2x^2} + \frac{\cos(c+dx)}{ax^5}\right)dx}{3b} - \frac{5\left(\frac{b^{5/3}\sin\left(c-\frac{\sqrt[3]{a}d}{\sqrt[3]{b}}\right)\text{CosIntegral}\left(xd+\frac{\sqrt[3]{a}d}{\sqrt[3]{b}}\right)}{3a^{8/3}} - \frac{\sqrt[3]{-1}b^{5/3}\sin\left(\frac{\sqrt[3]{-1}\sqrt[3]{a}d}{\sqrt[3]{b}}+c\right)\text{CosIntegral}\left(\frac{\sqrt[3]{-1}\sqrt[3]{a}d}{\sqrt[3]{b}}-dx\right)}{3a^{8/3}} + \frac{(-1)^{2/3}b^{5/3}\sin\left(c\right.}{}\right.}{}$$

$$\frac{\sin(c+dx)}{3bx^5(a+bx^3)}$$

$\downarrow$ 2009

$$-\frac{\sin(c+dx)}{3bx^5(bx^3+a)} - \frac{5\left(\frac{\cos(c)\text{CosIntegral}(dx)d^5}{120a} - \frac{\sin(c)\text{Si}(dx)d^5}{120a} - \frac{\sin(c+dx)d^4}{120ax} + \frac{\cos(c+dx)d^3}{120ax^2} + \frac{b\,\text{CosIntegral}(dx)\sin(c)d^2}{2a^2} + \frac{\sin(c+dx)d^2}{60ax^3} + \frac{b\cos(c)\text{Si}(d}{2a^2}\right.}{}$$

$$\frac{d\left(\frac{\cos(c)\text{CosIntegral}(dx)d^4}{24a} - \frac{\sin(c)\text{Si}(dx)d^4}{24a} - \frac{\sin(c+dx)d^3}{24ax} + \frac{\cos(c+dx)d^2}{24ax^2} + \frac{b\,\text{CosIntegral}(dx)\sin(c)d}{a^2} + \frac{\sin(c+dx)d}{12ax^3} + \frac{b\cos(c)\text{Si}(dx)}{a^2}\right.}{}$$

input
```
Int[Sin[c + d*x]/(x^3*(a + b*x^3)^2),x]
```

3.108. $\int \frac{\sin(c+dx)}{x^3(a+bx^3)^2}\,dx$

output
```
-1/3*Sin[c + d*x]/(b*x^5*(a + b*x^3)) - (5*(-1/20*(d*Cos[c + d*x])/(a*x^4)
 + (d^3*Cos[c + d*x])/(120*a*x^2) + (b*d*Cos[c + d*x])/(2*a^2*x) + (d^5*Co
s[c]*CosIntegral[d*x])/(120*a) + (b*d^2*CosIntegral[d*x]*Sin[c])/(2*a^2) +
 (b^(5/3)*CosIntegral[(a^(1/3)*d)/b^(1/3) + d*x]*Sin[c - (a^(1/3)*d)/b^(1/
3)])/(3*a^(8/3)) - ((-1)^(1/3)*b^(5/3)*CosIntegral[((-1)^(1/3)*a^(1/3)*d)/
b^(1/3) - d*x]*Sin[c + ((-1)^(1/3)*a^(1/3)*d)/b^(1/3)])/(3*a^(8/3)) + ((-1
)^(2/3)*b^(5/3)*CosIntegral[((-1)^(2/3)*a^(1/3)*d)/b^(1/3) + d*x]*Sin[c -
((-1)^(2/3)*a^(1/3)*d)/b^(1/3)])/(3*a^(8/3)) - Sin[c + d*x]/(5*a*x^5) + (d
^2*Sin[c + d*x])/(60*a*x^3) + (b*Sin[c + d*x])/(2*a^2*x^2) - (d^4*Sin[c +
d*x])/(120*a*x) + (b*d^2*Cos[c]*SinIntegral[d*x])/(2*a^2) - (d^5*Sin[c]*Si
nIntegral[d*x])/(120*a) + ((-1)^(1/3)*b^(5/3)*Cos[c + ((-1)^(1/3)*a^(1/3)*
d)/b^(1/3)]*SinIntegral[((-1)^(1/3)*a^(1/3)*d)/b^(1/3) - d*x])/(3*a^(8/3))
 + (b^(5/3)*Cos[c - (a^(1/3)*d)/b^(1/3)]*SinIntegral[(a^(1/3)*d)/b^(1/3) +
 d*x])/(3*a^(8/3)) + ((-1)^(2/3)*b^(5/3)*Cos[c - ((-1)^(2/3)*a^(1/3)*d)/b^
(1/3)]*SinIntegral[((-1)^(2/3)*a^(1/3)*d)/b^(1/3) + d*x])/(3*a^(8/3))))/(3
*b) + (d*(-1/4*Cos[c + d*x]/(a*x^4) + (d^2*Cos[c + d*x])/(24*a*x^2) + (b*C
os[c + d*x])/(a^2*x) + (d^4*Cos[c]*CosIntegral[d*x])/(24*a) - ((-1)^(2/3)*
b^(4/3)*Cos[c + ((-1)^(1/3)*a^(1/3)*d)/b^(1/3)]*CosIntegral[((-1)^(1/3)*a^
(1/3)*d)/b^(1/3) - d*x])/(3*a^(7/3)) - (b^(4/3)*Cos[c - (a^(1/3)*d)/b^(1/3
)]*CosIntegral[(a^(1/3)*d)/b^(1/3) + d*x])/(3*a^(7/3)) + ((-1)^(1/3)*b^...
```

### 3.108.3.1 Defintions of rubi rules used

rule 2009
```
Int[u_, x_Symbol] :> Simp[IntSum[u, x], x] /; SumQ[u]
```

rule 3824
```
Int[(x_)^(m_.)*((a_) + (b_.)*(x_)^(n_))^(p_)*Sin[(c_.) + (d_.)*(x_)], x_Sym
bol] :> Simp[x^(m - n + 1)*(a + b*x^n)^(p + 1)*(Sin[c + d*x]/(b*n*(p + 1)))
, x] + (-Simp[(m - n + 1)/(b*n*(p + 1))   Int[x^(m - n)*(a + b*x^n)^(p + 1)
*Sin[c + d*x], x], x] - Simp[d/(b*n*(p + 1))   Int[x^(m - n + 1)*(a + b*x^n
)^(p + 1)*Cos[c + d*x], x], x]) /; FreeQ[{a, b, c, d, m}, x] && ILtQ[p, -1]
 && IGtQ[n, 0] && (GtQ[m - n + 1, 0] || GtQ[n, 2]) && RationalQ[m]
```

rule 3826
```
Int[(x_)^(m_.)*((a_) + (b_.)*(x_)^(n_))^(p_)*Sin[(c_.) + (d_.)*(x_)], x_Sym
bol] :> Int[ExpandIntegrand[Sin[c + d*x], x^m*(a + b*x^n)^p, x], x] /; Free
Q[{a, b, c, d, m}, x] && ILtQ[p, 0] && IGtQ[n, 0] && (EqQ[n, 2] || EqQ[p, -
1]) && IntegerQ[m]
```

rule 3827
```
Int[Cos[(c_.) + (d_.)*(x_)]*(x_)^(m_.)*((a_) + (b_.)*(x_)^(n_))^(p_), x_Sym
bol] :> Int[ExpandIntegrand[Cos[c + d*x], x^m*(a + b*x^n)^p, x], x] /; Free
Q[{a, b, c, d, m}, x] && ILtQ[p, 0] && IGtQ[n, 0] && (EqQ[n, 2] || EqQ[p, -
1]) && IntegerQ[m]
```

### 3.108.4 Maple [C] (verified)

Result contains higher order function than in optimal. Order 9 vs. order 4.

Time = 0.93 (sec) , antiderivative size = 315, normalized size of antiderivative = 0.39

| method | result |
|---|---|
| risch | $-\frac{i d^2 \operatorname{Ei}_1(-idx)\mathrm{e}^{ic}}{4a^2} - \frac{i d^2 \left( \sum_{\_R1=\operatorname{RootOf}\left(-3i\_Z^2 bc - id^3 a + ib c^3 + b\_Z^3 - 3c^2 b\_Z\right)} \frac{\left(-ic+\_R1-5\right)\mathrm{e}^{\_R1} \operatorname{Ei}_1\left(-idx-ic+\right.}{-2ic\_R1+\_R1^2-c^2}\right.}{18a^2}$ |
| derivativedivides | $d^2 \left( \frac{-\frac{\sin(dx+c)}{2d^2x^2} - \frac{\cos(dx+c)}{2dx} - \frac{\operatorname{Si}(dx)\cos(c)}{2} - \frac{\operatorname{Ci}(dx)\sin(c)}{2}}{a^2} - \frac{b d^3 \left( \frac{\sin(dx+c)\left(\frac{dx+c}{3a d^3} - \frac{c}{3a d^3}\right)}{a d^3 - c^3 b + 3b c^2 (dx+c) - 3bc(dx+c)^2 + b(dx+c)^3} + \frac{2\left(\_R1\right.}{} \right.}{} \right.$ |
| default | $d^2 \left( \frac{-\frac{\sin(dx+c)}{2d^2x^2} - \frac{\cos(dx+c)}{2dx} - \frac{\operatorname{Si}(dx)\cos(c)}{2} - \frac{\operatorname{Ci}(dx)\sin(c)}{2}}{a^2} - \frac{b d^3 \left( \frac{\sin(dx+c)\left(\frac{dx+c}{3a d^3} - \frac{c}{3a d^3}\right)}{a d^3 - c^3 b + 3b c^2 (dx+c) - 3bc(dx+c)^2 + b(dx+c)^3} + \frac{2\left(\_R1\right.}{} \right.}{} \right.$ |

input
```
int(sin(d*x+c)/x^3/(b*x^3+a)^2,x,method=_RETURNVERBOSE)
```

output
```
-1/4*I*d^2/a^2*Ei(1,-I*d*x)*exp(I*c)-1/18*I*d^2/a^2*sum((-I*c+_R1-5)/(-2*I
*c*_R1+_R1^2-c^2)*exp(_R1)*Ei(1,_R1-I*d*x-I*c),_R1=RootOf(-3*I*_Z^2*b*c-I*
d^3*a+I*b*c^3+b*_Z^3-3*c^2*b*_Z))+1/4*I*d^2/a^2*Ei(1,I*d*x)*exp(-I*c)-1/18
*I*d^2/a^2*sum((-I*c+_R1+5)/(-2*I*c*_R1+_R1^2-c^2)*exp(-_R1)*Ei(1,I*d*x+I*
c-_R1),_R1=RootOf(-3*I*_Z^2*b*c-I*d^3*a+I*b*c^3+b*_Z^3-3*c^2*b*_Z))+1/2*(-
b*d^4*x^4-a*d^4*x)/a^2/x^2/(b*d^3*x^3+a*d^3)*cos(d*x+c)-1/6*(5*b*d^3*x^3+3
*a*d^3)/a^2/x^2/(b*d^3*x^3+a*d^3)*sin(d*x+c)
```

## 3.108.5 Fricas [C] (verification not implemented)

Result contains complex when optimal does not.

Time = 0.35 (sec) , antiderivative size = 898, normalized size of antiderivative = 1.12

$$\int \frac{\sin(c+dx)}{x^3\left(a+bx^3\right)^2}\,dx = \text{Too large to display}$$

input
```
integrate(sin(d*x+c)/x^3/(b*x^3+a)^2,x, algorithm="fricas")
```

output
```
-1/36*(((b^2*x^5 + a*b*x^2 - sqrt(3)*(I*b^2*x^5 + I*a*b*x^2))*(I*a*d^3/b)^
(2/3) + 5*(b^2*x^5 + a*b*x^2 + sqrt(3)*(I*b^2*x^5 + I*a*b*x^2))*(I*a*d^3/b
)^(1/3))*Ei(-I*d*x + 1/2*(I*a*d^3/b)^(1/3)*(-I*sqrt(3) - 1))*e^(1/2*(I*a*d
^3/b)^(1/3)*(I*sqrt(3) + 1) - I*c) + ((b^2*x^5 + a*b*x^2 - sqrt(3)*(I*b^2*
x^5 + I*a*b*x^2))*(-I*a*d^3/b)^(2/3) + 5*(b^2*x^5 + a*b*x^2 + sqrt(3)*(I*b
^2*x^5 + I*a*b*x^2))*(-I*a*d^3/b)^(1/3))*Ei(I*d*x + 1/2*(-I*a*d^3/b)^(1/3)
*(-I*sqrt(3) - 1))*e^(1/2*(-I*a*d^3/b)^(1/3)*(I*sqrt(3) + 1) + I*c) + ((b^
2*x^5 + a*b*x^2 - sqrt(3)*(-I*b^2*x^5 - I*a*b*x^2))*(I*a*d^3/b)^(2/3) + 5*
(b^2*x^5 + a*b*x^2 + sqrt(3)*(-I*b^2*x^5 - I*a*b*x^2))*(I*a*d^3/b)^(1/3))*
Ei(-I*d*x + 1/2*(I*a*d^3/b)^(1/3)*(I*sqrt(3) - 1))*e^(1/2*(I*a*d^3/b)^(1/3
)*(-I*sqrt(3) + 1) - I*c) + ((b^2*x^5 + a*b*x^2 - sqrt(3)*(-I*b^2*x^5 - I*
a*b*x^2))*(-I*a*d^3/b)^(2/3) + 5*(b^2*x^5 + a*b*x^2 + sqrt(3)*(-I*b^2*x^5
- I*a*b*x^2))*(-I*a*d^3/b)^(1/3))*Ei(I*d*x + 1/2*(-I*a*d^3/b)^(1/3)*(I*sqr
t(3) - 1))*e^(1/2*(-I*a*d^3/b)^(1/3)*(-I*sqrt(3) + 1) + I*c) - 2*((b^2*x^5
 + a*b*x^2)*(-I*a*d^3/b)^(2/3) + 5*(b^2*x^5 + a*b*x^2)*(-I*a*d^3/b)^(1/3))
*Ei(I*d*x + (-I*a*d^3/b)^(1/3))*e^(I*c - (-I*a*d^3/b)^(1/3)) - 2*((b^2*x^5
 + a*b*x^2)*(I*a*d^3/b)^(2/3) + 5*(b^2*x^5 + a*b*x^2)*(I*a*d^3/b)^(1/3))*E
i(-I*d*x + (I*a*d^3/b)^(1/3))*e^(-I*c - (I*a*d^3/b)^(1/3)) + 18*(a*b*d^3*x
^5 + a^2*d^3*x^2)*cos_integral(d*x)*sin(c) + 18*(a*b*d^3*x^5 + a^2*d^3*x^2
)*cos(c)*sin_integral(d*x) + 18*(a*b*d^2*x^4 + a^2*d^2*x)*cos(d*x + c) ...
```

### 3.108.6 Sympy [F(-1)]

Timed out.

$$\int \frac{\sin(c+dx)}{x^3\left(a+bx^3\right)^2}\,dx = \text{Timed out}$$

input
```
integrate(sin(d*x+c)/x**3/(b*x**3+a)**2,x)
```

output
```
Timed out
```

### 3.108.7 Maxima [F]

$$\int \frac{\sin(c+dx)}{x^3\left(a+bx^3\right)^2}\,dx = \int \frac{\sin\left(dx+c\right)}{\left(bx^3+a\right)^2x^3}\,dx$$

input
```
integrate(sin(d*x+c)/x^3/(b*x^3+a)^2,x, algorithm="maxima")
```

output
```
integrate(sin(d*x + c)/((b*x^3 + a)^2*x^3), x)
```

### 3.108.8 Giac [F]

$$\int \frac{\sin(c+dx)}{x^3\left(a+bx^3\right)^2}\,dx = \int \frac{\sin\left(dx+c\right)}{\left(bx^3+a\right)^2x^3}\,dx$$

input
```
integrate(sin(d*x+c)/x^3/(b*x^3+a)^2,x, algorithm="giac")
```

output
```
integrate(sin(d*x + c)/((b*x^3 + a)^2*x^3), x)
```

### 3.108.9 Mupad [F(-1)]

Timed out.

$$\int \frac{\sin(c+dx)}{x^3 (a+bx^3)^2} \, dx = \int \frac{\sin(c+d\,x)}{x^3 \left(b\,x^3+a\right)^2} \, dx$$

input
```
int(sin(c + d*x)/(x^3*(a + b*x^3)^2),x)
```

output
```
int(sin(c + d*x)/(x^3*(a + b*x^3)^2), x)
```

# 3.109 $\int \frac{x^3 \sin(c+dx)}{(a+bx^3)^3} \, dx$

### 3.109.1 Optimal result

Integrand size = 19, antiderivative size = 772

$$\int \frac{x^3\sin(c+dx)}{(a+bx^3)^3}\,dx = \frac{d\cos(c+dx)}{18ab^2x} - \frac{d\cos(c+dx)}{18b^2x\,(a+bx^3)} + \frac{\text{CosIntegral}\left(\frac{\sqrt[3]{a}d}{\sqrt[3]{b}}+dx\right)\sin\left(c-\frac{\sqrt[3]{a}d}{\sqrt[3]{b}}\right)}{27a^{5/3}b^{4/3}} + \frac{d^2\,\text{CosIntegral}\left(\frac{\sqrt[3]{a}d}{\sqrt[3]{b}}+dx\right)\sin\left(c-\frac{\sqrt[3]{a}d}{\sqrt[3]{b}}\right)}{54ab^2} - \frac{\sqrt[3]{-1}\,\text{CosIntegral}\left(\frac{\sqrt[3]{-1}\sqrt[3]{a}d}{\sqrt[3]{b}}-dx\right)\sin\left(c+\frac{\sqrt[3]{-1}\sqrt[3]{a}d}{\sqrt[3]{b}}\right)}{27a^{5/3}b^{4/3}} + \frac{d^2\,\text{CosIntegral}\left(\frac{\sqrt[3]{-1}\sqrt[3]{a}d}{\sqrt[3]{b}}-dx\right)\sin\left(c+\frac{\sqrt[3]{-1}\sqrt[3]{a}d}{\sqrt[3]{b}}\right)}{54ab^2} + \frac{(-1)^{2/3}\,\text{CosIntegral}\left(\frac{(-1)^{2/3}\sqrt[3]{a}d}{\sqrt[3]{b}}+dx\right)\sin\left(c-\frac{(-1)^{2/3}\sqrt[3]{a}d}{\sqrt[3]{b}}\right)}{27a^{5/3}b^{4/3}} + \frac{d^2\,\text{CosIntegral}\left(\frac{(-1)^{2/3}\sqrt[3]{a}d}{\sqrt[3]{b}}+dx\right)\sin\left(c-\frac{(-1)^{2/3}\sqrt[3]{a}d}{\sqrt[3]{b}}\right)}{54ab^2} + \frac{\sin(c+dx)}{18ab^2x^2} - \frac{x\sin(c+dx)}{6b\,(a+bx^3)^2} - \frac{\sin(c+dx)}{18b^2x^2\,(a+bx^3)} + \frac{\sqrt[3]{-1}\cos\left(c+\frac{\sqrt[3]{-1}\sqrt[3]{a}d}{\sqrt[3]{b}}\right)\text{Si}\left(\frac{\sqrt[3]{-1}\sqrt[3]{a}d}{\sqrt[3]{b}}-dx\right)}{27a^{5/3}b^{4/3}} - \frac{d^2\cos\left(c+\frac{\sqrt[3]{-1}\sqrt[3]{a}d}{\sqrt[3]{b}}\right)\text{Si}\left(\frac{\sqrt[3]{-1}\sqrt[3]{a}d}{\sqrt[3]{b}}-dx\right)}{54ab^2} + \frac{\cos\left(c-\frac{\sqrt[3]{a}d}{\sqrt[3]{b}}\right)\text{Si}\left(\frac{\sqrt[3]{a}d}{\sqrt[3]{b}}+dx\right)}{27a^{5/3}b^{4/3}} + \frac{d^2\cos\left(c-\frac{\sqrt[3]{a}d}{\sqrt[3]{b}}\right)\text{Si}\left(\frac{\sqrt[3]{a}d}{\sqrt[3]{b}}+dx\right)}{54ab^2} + \frac{(-1)^{2/3}\cos\left(c-\frac{(-1)^{2/3}\sqrt[3]{a}d}{\sqrt[3]{b}}\right)\text{Si}\left(\frac{(-1)^{2/3}\sqrt[3]{a}d}{\sqrt[3]{b}}+dx\right)}{27a^{5/3}b^{4/3}} + \frac{d^2\cos\left(c-\frac{(-1)^{2/3}\sqrt[3]{a}d}{\sqrt[3]{b}}\right)\text{Si}\left(\frac{(-1)^{2/3}\sqrt[3]{a}d}{\sqrt[3]{b}}+dx\right)}{54ab^2}$$

output
```
1/18*d*cos(d*x+c)/a/b^2/x-1/18*d*cos(d*x+c)/b^2/x/(b*x^3+a)-1/27*(-1)^(1/3
)*cos(c+(-1)^(1/3)*a^(1/3)*d/b^(1/3))*Si(-(-1)^(1/3)*a^(1/3)*d/b^(1/3)+d*x
)/a^(5/3)/b^(4/3)+1/54*d^2*cos(c+(-1)^(1/3)*a^(1/3)*d/b^(1/3))*Si(-(-1)^(1
/3)*a^(1/3)*d/b^(1/3)+d*x)/a/b^2+1/27*cos(c-a^(1/3)*d/b^(1/3))*Si(a^(1/3)*
d/b^(1/3)+d*x)/a^(5/3)/b^(4/3)+1/54*d^2*cos(c-a^(1/3)*d/b^(1/3))*Si(a^(1/3
)*d/b^(1/3)+d*x)/a/b^2+1/27*(-1)^(2/3)*cos(c-(-1)^(2/3)*a^(1/3)*d/b^(1/3))
*Si((-1)^(2/3)*a^(1/3)*d/b^(1/3)+d*x)/a^(5/3)/b^(4/3)+1/54*d^2*cos(c-(-1)^
(2/3)*a^(1/3)*d/b^(1/3))*Si((-1)^(2/3)*a^(1/3)*d/b^(1/3)+d*x)/a/b^2+1/27*C
i(a^(1/3)*d/b^(1/3)+d*x)*sin(c-a^(1/3)*d/b^(1/3))/a^(5/3)/b^(4/3)+1/54*d^2
*Ci(a^(1/3)*d/b^(1/3)+d*x)*sin(c-a^(1/3)*d/b^(1/3))/a/b^2-1/27*(-1)^(1/3)*
Ci((-1)^(1/3)*a^(1/3)*d/b^(1/3)-d*x)*sin(c+(-1)^(1/3)*a^(1/3)*d/b^(1/3))/a
^(5/3)/b^(4/3)+1/54*d^2*Ci((-1)^(1/3)*a^(1/3)*d/b^(1/3)-d*x)*sin(c+(-1)^(1
/3)*a^(1/3)*d/b^(1/3))/a/b^2+1/27*(-1)^(2/3)*Ci((-1)^(2/3)*a^(1/3)*d/b^(1/
3)+d*x)*sin(c-(-1)^(2/3)*a^(1/3)*d/b^(1/3))/a^(5/3)/b^(4/3)+1/54*d^2*Ci((-
1)^(2/3)*a^(1/3)*d/b^(1/3)+d*x)*sin(c-(-1)^(2/3)*a^(1/3)*d/b^(1/3))/a/b^2+
1/18*sin(d*x+c)/a/b^2/x^2-1/6*x*sin(d*x+c)/b/(b*x^3+a)^2-1/18*sin(d*x+c)/b
^2/x^2/(b*x^3+a)
```

### 3.109.2 Mathematica [C] (verified)

Result contains higher order function than in optimal. Order 9 vs. order 4 in optimal.

Time = 0.46 (sec) , antiderivative size = 457, normalized size of antiderivative = 0.59

$$\int \frac{x^3 \sin(c+dx)}{(a+bx^3)^3} \, dx$$
$$= \frac{i\text{RootSum}\left[a+b\#1^3\&, \frac{2\cos(c+d\#1)\,\text{CosIntegral}(d(x-\#1))-2i\,\text{CosIntegral}(d(x-\#1))\sin(c+d\#1)-2i\cos(c+d\#1)\text{Si}(d(x-\#1}{}\right.}{}$$

input
```
Integrate[(x^3*Sin[c + d*x])/(a + b*x^3)^3,x]
```

output
```
(I*RootSum[a + b*#1^3 & , (2*Cos[c + d*#1]*CosIntegral[d*(x - #1)] - (2*I)
*CosIntegral[d*(x - #1)]*Sin[c + d*#1] - (2*I)*Cos[c + d*#1]*SinIntegral[d
*(x - #1)] - 2*Sin[c + d*#1]*SinIntegral[d*(x - #1)] + d^2*Cos[c + d*#1]*C
osIntegral[d*(x - #1)]*#1^2 - I*d^2*CosIntegral[d*(x - #1)]*Sin[c + d*#1]*
#1^2 - I*d^2*Cos[c + d*#1]*SinIntegral[d*(x - #1)]*#1^2 - d^2*Sin[c + d*#1
]*SinIntegral[d*(x - #1)]*#1^2)/#1^2 & ] - I*RootSum[a + b*#1^3 & , (2*Cos
[c + d*#1]*CosIntegral[d*(x - #1)] + (2*I)*CosIntegral[d*(x - #1)]*Sin[c +
 d*#1] + (2*I)*Cos[c + d*#1]*SinIntegral[d*(x - #1)] - 2*Sin[c + d*#1]*Sin
Integral[d*(x - #1)] + d^2*Cos[c + d*#1]*CosIntegral[d*(x - #1)]*#1^2 + I*
d^2*CosIntegral[d*(x - #1)]*Sin[c + d*#1]*#1^2 + I*d^2*Cos[c + d*#1]*SinIn
tegral[d*(x - #1)]*#1^2 - d^2*Sin[c + d*#1]*SinIntegral[d*(x - #1)]*#1^2)/
#1^2 & ] + (6*b*x*(d*x*(a + b*x^3)*Cos[c + d*x] + (-2*a + b*x^3)*Sin[c + d
*x]))/(a + b*x^3)^2)/(108*a*b^2)
```

### 3.109.3 Rubi [B] (verified)

Leaf count is larger than twice the leaf count of optimal. 1592 vs. $2(772) = 1544$.

Time = 3.48 (sec) , antiderivative size = 1592, normalized size of antiderivative = 2.06, number of steps used = 7, number of rules used = 7, $\frac{\text{number of rules}}{\text{integrand size}} = 0.368$, Rules used = {3824, 3812, 3825, 3826, 2009, 3827, 2009}

Below are the steps used by Rubi to obtain the solution. The rule number used for the transformation is given above next to the arrow. The rules definitions used are listed below.

$$\int \frac{x^3 \sin(c+dx)}{(a+bx^3)^3} \, dx$$

$$\Big\downarrow \text{3824}$$

$$\frac{\int \frac{\sin(c+dx)}{(bx^3+a)^2}dx}{6b}+\frac{d\int \frac{x\cos(c+dx)}{(bx^3+a)^2}dx}{6b}-\frac{x\sin(c+dx)}{6b(a+bx^3)^2}$$

$$\Big\downarrow \text{3812}$$

$$\frac{d\int \frac{x\cos(c+dx)}{(bx^3+a)^2}dx}{6b}+\frac{-\frac{2\int \frac{\sin(c+dx)}{x^3(bx^3+a)}dx}{3b}+\frac{d\int \frac{\cos(c+dx)}{x^2(bx^3+a)}dx}{3b}-\frac{\sin(c+dx)}{3bx^2(a+bx^3)}}{6b}-\frac{x\sin(c+dx)}{6b(a+bx^3)^2}$$

$$\Big\downarrow \text{3825}$$

$$\frac{-\frac{2\int \frac{\sin(c+dx)}{x^3\left(bx^3+a\right)}dx}{3b}+\frac{d\int \frac{\cos(c+dx)}{x^2\left(bx^3+a\right)}dx}{3b}-\frac{\sin(c+dx)}{3bx^2(a+bx^3)}}{6b}+\frac{d\left(-\frac{d\int \frac{\sin(c+dx)}{x\left(bx^3+a\right)}dx}{3b}-\frac{\int \frac{\cos(c+dx)}{x^2\left(bx^3+a\right)}dx}{3b}-\frac{\cos(c+dx)}{3bx(a+bx^3)}\right)}{6b}-\frac{x\sin(c+dx)}{6b\left(a+bx^3\right)^2}$$

$$\Big\downarrow \text{3826}$$

$$\frac{-\frac{2\int \left(\frac{\sin(c+dx)}{ax^3}-\frac{b\sin(c+dx)}{a\left(bx^3+a\right)}\right)dx}{3b}+\frac{d\int \frac{\cos(c+dx)}{x^2\left(bx^3+a\right)}dx}{3b}-\frac{\sin(c+dx)}{3bx^2(a+bx^3)}}{6b}+\frac{d\left(-\frac{d\int \left(\frac{\sin(c+dx)}{ax}-\frac{bx^2\sin(c+dx)}{a\left(bx^3+a\right)}\right)dx}{3b}-\frac{\int \frac{\cos(c+dx)}{x^2\left(bx^3+a\right)}dx}{3b}-\frac{\cos(c+dx)}{3bx(a+bx^3)}\right)}{6b}-\frac{x\sin(c+dx)}{6b\left(a+bx^3\right)^2}$$

$$\Big\downarrow \text{2009}$$

$$-\frac{x\sin(c+dx)}{6b\left(bx^3+a\right)^2}+$$

$$d\left(-\frac{\cos(c+dx)}{3bx(bx^3+a)}-\frac{d\left(\frac{\text{CosIntegral}(dx)\sin(c)}{a}-\frac{\text{CosIntegral}\left(xd+\frac{\sqrt[3]{a}d}{\sqrt[3]{b}}\right)\sin\left(c-\frac{\sqrt[3]{a}d}{\sqrt[3]{b}}\right)}{3a}-\frac{\text{CosIntegral}\left(\frac{\sqrt[3]{-1}\sqrt[3]{a}d}{\sqrt[3]{b}}-dx\right)\sin\left(c+\frac{\sqrt[3]{-1}\sqrt[3]{a}d}{\sqrt[3]{b}}\right)}{3a}-\cdots\right.}{\cdots}\right.$$

$$-\frac{\sin(c+dx)}{3bx^2(bx^3+a)}-\frac{2\left(-\frac{\text{CosIntegral}(dx)\sin(c)d^2}{2a}-\frac{\cos(c)\text{Si}(dx)d^2}{2a}-\frac{\cos(c+dx)d}{2ax}-\frac{b^{2/3}\text{CosIntegral}\left(xd+\frac{\sqrt[3]{a}d}{\sqrt[3]{b}}\right)\sin\left(c-\frac{\sqrt[3]{a}d}{\sqrt[3]{b}}\right)}{3a^{5/3}}+\frac{\sqrt[3]{-1}b^{2/3}\text{CosIntegral}\cdots}{\cdots}\right.}{\cdots}$$

$$\Big\downarrow \text{3827}$$

3.109. $\int \frac{x^3\sin(c+dx)}{(a+bx^3)^3}\,dx$

$$-\frac{x\sin(c+dx)}{6b\left(bx^3+a\right)^2}+$$

$$\frac{d\left(-\frac{\cos(c+dx)}{3bx(bx^3+a)}-\frac{d\left(\frac{\text{CosIntegral}(dx)\sin(c)}{a}-\frac{\text{CosIntegral}\left(xd+\frac{\sqrt[3]{a}d}{\sqrt[3]{b}}\right)\sin\left(c-\frac{\sqrt[3]{a}d}{\sqrt[3]{b}}\right)}{3a}-\frac{\text{CosIntegral}\left(\frac{\sqrt[3]{-1}\sqrt[3]{a}d}{\sqrt[3]{b}}-dx\right)\sin\left(c+\frac{\sqrt[3]{-1}\sqrt[3]{a}d}{\sqrt[3]{b}}\right)}{3a}-\cdots\right.}{\cdots}\right.}{-\frac{\sin(c+dx)}{3bx^2(bx^3+a)}-\frac{2\left(-\frac{\text{CosIntegral}(dx)\sin(c)d^2}{2a}-\frac{\cos(c)\text{Si}(dx)d^2}{2a}-\frac{\cos(c+dx)d}{2ax}-\frac{b^{2/3}\,\text{CosIntegral}\left(xd+\frac{\sqrt[3]{a}d}{\sqrt[3]{b}}\right)\sin\left(c-\frac{\sqrt[3]{a}d}{\sqrt[3]{b}}\right)}{3a^{5/3}}+\frac{\sqrt[3]{-1}b^{2/3}\,\text{CosIntegral}\cdots}{\cdots}\right.}{\cdots}}$$

$$\Big\downarrow \; 2009$$


$$-\frac{x\sin(c+dx)}{6b\left(bx^3+a\right)^2}+$$

$$\frac{d\left(-\frac{\cos(c+dx)}{3bx(bx^3+a)}-\frac{d\left(\frac{\text{CosIntegral}(dx)\sin(c)}{a}-\frac{\text{CosIntegral}\left(xd+\frac{\sqrt[3]{a}d}{\sqrt[3]{b}}\right)\sin\left(c-\frac{\sqrt[3]{a}d}{\sqrt[3]{b}}\right)}{3a}-\frac{\text{CosIntegral}\left(\frac{\sqrt[3]{-1}\sqrt[3]{a}d}{\sqrt[3]{b}}-dx\right)\sin\left(c+\frac{\sqrt[3]{-1}\sqrt[3]{a}d}{\sqrt[3]{b}}\right)}{3a}-\cdots\right.}{\cdots}\right.}{-\frac{\sin(c+dx)}{3bx^2(bx^3+a)}-\frac{2\left(-\frac{\text{CosIntegral}(dx)\sin(c)d^2}{2a}-\frac{\cos(c)\text{Si}(dx)d^2}{2a}-\frac{\cos(c+dx)d}{2ax}-\frac{b^{2/3}\,\text{CosIntegral}\left(xd+\frac{\sqrt[3]{a}d}{\sqrt[3]{b}}\right)\sin\left(c-\frac{\sqrt[3]{a}d}{\sqrt[3]{b}}\right)}{3a^{5/3}}+\frac{\sqrt[3]{-1}b^{2/3}\,\text{CosIntegral}\cdots}{\cdots}\right.}{\cdots}}$$


input
```
Int[(x^3*Sin[c + d*x])/(a + b*x^3)^3,x]
```

## 3.109. $\int \frac{x^3\sin(c+dx)}{(a+bx^3)^3}\,dx$

output
```
-1/6*(x*Sin[c + d*x])/(b*(a + b*x^3)^2) + (d*(-1/3*Cos[c + d*x]/(b*x*(a +
b*x^3)) - (d*((CosIntegral[d*x]*Sin[c])/a - (CosIntegral[(a^(1/3)*d)/b^(1/
3) + d*x]*Sin[c - (a^(1/3)*d)/b^(1/3)])/(3*a) - (CosIntegral[((-1)^(1/3)*a
^(1/3)*d)/b^(1/3) - d*x]*Sin[c + ((-1)^(1/3)*a^(1/3)*d)/b^(1/3)])/(3*a) -
(CosIntegral[((-1)^(2/3)*a^(1/3)*d)/b^(1/3) + d*x]*Sin[c - ((-1)^(2/3)*a^(
1/3)*d)/b^(1/3)])/(3*a) + (Cos[c]*SinIntegral[d*x])/a + (Cos[c + ((-1)^(1/
3)*a^(1/3)*d)/b^(1/3)]*SinIntegral[((-1)^(1/3)*a^(1/3)*d)/b^(1/3) - d*x])/
(3*a) - (Cos[c - (a^(1/3)*d)/b^(1/3)]*SinIntegral[(a^(1/3)*d)/b^(1/3) + d*
x])/(3*a) - (Cos[c - ((-1)^(2/3)*a^(1/3)*d)/b^(1/3)]*SinIntegral[((-1)^(2/
3)*a^(1/3)*d)/b^(1/3) + d*x])/(3*a)))/(3*b) - (-(Cos[c + d*x]/(a*x)) + ((-
1)^(2/3)*b^(1/3)*Cos[c + ((-1)^(1/3)*a^(1/3)*d)/b^(1/3)]*CosIntegral[((-1)
^(1/3)*a^(1/3)*d)/b^(1/3) - d*x])/(3*a^(4/3)) + (b^(1/3)*Cos[c - (a^(1/3)*
d)/b^(1/3)]*CosIntegral[(a^(1/3)*d)/b^(1/3) + d*x])/(3*a^(4/3)) - ((-1)^(1
/3)*b^(1/3)*Cos[c - ((-1)^(2/3)*a^(1/3)*d)/b^(1/3)]*CosIntegral[((-1)^(2/3
)*a^(1/3)*d)/b^(1/3) + d*x])/(3*a^(4/3)) - (d*CosIntegral[d*x]*Sin[c])/a -
 (d*Cos[c]*SinIntegral[d*x])/a + ((-1)^(2/3)*b^(1/3)*Sin[c + ((-1)^(1/3)*a
^(1/3)*d)/b^(1/3)]*SinIntegral[((-1)^(1/3)*a^(1/3)*d)/b^(1/3) - d*x])/(3*a
^(4/3)) - (b^(1/3)*Sin[c - (a^(1/3)*d)/b^(1/3)]*SinIntegral[(a^(1/3)*d)/b^
(1/3) + d*x])/(3*a^(4/3)) + ((-1)^(1/3)*b^(1/3)*Sin[c - ((-1)^(2/3)*a^(1/3
)*d)/b^(1/3)]*SinIntegral[((-1)^(2/3)*a^(1/3)*d)/b^(1/3) + d*x])/(3*a^(...
```

#### 3.109.3.1 Defintions of rubi rules used

rule 2009
```
Int[u_, x_Symbol] :> Simp[IntSum[u, x], x] /; SumQ[u]
```

rule 3812
```
Int[((a_) + (b_.)*(x_)^(n_))^(p_)*Sin[(c_.) + (d_.)*(x_)], x_Symbol] :> Sim
p[x^(-n + 1)*(a + b*x^n)^(p + 1)*(Sin[c + d*x]/(b*n*(p + 1))), x] + (-Simp[
(-n + 1)/(b*n*(p + 1))   Int[((a + b*x^n)^(p + 1)*Sin[c + d*x])/x^n, x], x]
 - Simp[d/(b*n*(p + 1))   Int[x^(-n + 1)*(a + b*x^n)^(p + 1)*Cos[c + d*x],
x], x]) /; FreeQ[{a, b, c, d}, x] && ILtQ[p, -1] && IGtQ[n, 2]
```

rule 3824
```
Int[(x_)^(m_.)*((a_) + (b_.)*(x_)^(n_))^(p_)*Sin[(c_.) + (d_.)*(x_)], x_Sym
bol] :> Simp[x^(m - n + 1)*(a + b*x^n)^(p + 1)*(Sin[c + d*x]/(b*n*(p + 1)))
, x] + (-Simp[(m - n + 1)/(b*n*(p + 1))   Int[x^(m - n)*(a + b*x^n)^(p + 1)
*Sin[c + d*x], x], x] - Simp[d/(b*n*(p + 1))   Int[x^(m - n + 1)*(a + b*x^n
)^(p + 1)*Cos[c + d*x], x], x]) /; FreeQ[{a, b, c, d, m}, x] && ILtQ[p, -1]
 && IGtQ[n, 0] && (GtQ[m - n + 1, 0] || GtQ[n, 2]) && RationalQ[m]
```

## 3.109. $\int \frac{x^3 \sin(c+dx)}{(a+bx^3)^3} dx$

rule 3825
```
Int[Cos[(c_.) + (d_.)*(x_)]*(x_)^(m_.)*((a_) + (b_.)*(x_)^(n_))^(p_), x_Sym
bol] :> Simp[x^(m - n + 1)*(a + b*x^n)^(p + 1)*(Cos[c + d*x]/(b*n*(p + 1)))
, x] + (-Simp[(m - n + 1)/(b*n*(p + 1))   Int[x^(m - n)*(a + b*x^n)^(p + 1)
*Cos[c + d*x], x], x] + Simp[d/(b*n*(p + 1))   Int[x^(m - n + 1)*(a + b*x^n
)^(p + 1)*Sin[c + d*x], x], x]) /; FreeQ[{a, b, c, d, m}, x] && ILtQ[p, -1]
 && IGtQ[n, 0] && (GtQ[m - n + 1, 0] || GtQ[n, 2]) && RationalQ[m]
```

rule 3826
```
Int[(x_)^(m_.)*((a_) + (b_.)*(x_)^(n_))^(p_)*Sin[(c_.) + (d_.)*(x_)], x_Sym
bol] :> Int[ExpandIntegrand[Sin[c + d*x], x^m*(a + b*x^n)^p, x], x] /; Free
Q[{a, b, c, d, m}, x] && ILtQ[p, 0] && IGtQ[n, 0] && (EqQ[n, 2] || EqQ[p, -
1]) && IntegerQ[m]
```

rule 3827
```
Int[Cos[(c_.) + (d_.)*(x_)]*(x_)^(m_.)*((a_) + (b_.)*(x_)^(n_))^(p_), x_Sym
bol] :> Int[ExpandIntegrand[Cos[c + d*x], x^m*(a + b*x^n)^p, x], x] /; Free
Q[{a, b, c, d, m}, x] && ILtQ[p, 0] && IGtQ[n, 0] && (EqQ[n, 2] || EqQ[p, -
1]) && IntegerQ[m]
```

### 3.109.4 Maple [C] (verified)

Result contains higher order function than in optimal. Order 9 vs. order 4.

Time = 2.25 (sec) , antiderivative size = 1337, normalized size of antiderivative = 1.73

| method | result | size |
|---|---|---|
| risch | Expression too large to display | 1337 |
| derivativedivides | Expression too large to display | 2035 |
| default | Expression too large to display | 2035 |

input
```
int(x^3*sin(d*x+c)/(b*x^3+a)^3,x,method=_RETURNVERBOSE)
```

output
```
1/108*I/d/a^2/b*c^3*sum((-2*I*c*_R1+6*I*c+_R1^2-c^2-6*_R1+10)/(-2*I*c*_R1+
_R1^2-c^2)*exp(_R1)*Ei(1,_R1-I*d*x-I*c),_R1=RootOf(-3*I*_Z^2*b*c-I*d^3*a+I
*b*c^3+b*_Z^3-3*c^2*b*_Z))+1/36*I/d/a^2/b^2*c^2*sum((-2*I*b*_R1*c^2+4*I*b*
_R1^2+2*I*b*c^2+_R1^2*b*c+a*d^3-c^3*b-4*I*_R1*b+2*b*c*_R1+6*c*b)/(2*I*c*_R
1-_R1^2+c^2)*exp(_R1)*Ei(1,_R1-I*d*x-I*c),_R1=RootOf(-3*I*_Z^2*b*c-I*d^3*a
+I*b*c^3+b*_Z^3-3*c^2*b*_Z))+1/36*I/d/a^2/b^2*c*sum((I*_R1*a*d^3+2*I*_R1*b
*c^3-8*I*_R1^2*b*c-2*I*a*d^3+2*I*b*c^3-_R1^2*b*c^2-a*c*d^3+b*c^4+8*I*_R1*b
*c-10*_R1*b*c^2-2*c^2*b)/(2*I*c*_R1-_R1^2+c^2)*exp(_R1)*Ei(1,_R1-I*d*x-I*c
),_R1=RootOf(-3*I*_Z^2*b*c-I*d^3*a+I*b*c^3+b*_Z^3-3*c^2*b*_Z))-1/108*I/d/a
^2/b^2*sum((I*_R1*a*c*d^3+2*I*_R1*b*c^4-12*I*_R1^2*b*c^2-6*I*a*c*d^3+6*I*b
*c^4+_R1^2*a*d^3-_R1^2*b*c^3-a*c^2*d^3+c^5*b+12*I*b*_R1*c^2-18*_R1*b*c^3-2
*a*d^3+2*c^3*b)/(2*I*c*_R1-_R1^2+c^2)*exp(_R1)*Ei(1,_R1-I*d*x-I*c),_R1=Roo
tOf(-3*I*_Z^2*b*c-I*d^3*a+I*b*c^3+b*_Z^3-3*c^2*b*_Z))-1/108*I/d/a^2/b*c^3*
sum((-2*I*c*_R1-6*I*c+_R1^2-c^2+6*_R1+10)/(-2*I*c*_R1+_R1^2-c^2)*exp(-_R1)
*Ei(1,I*d*x+I*c-_R1),_R1=RootOf(-3*I*_Z^2*b*c-I*d^3*a+I*b*c^3+b*_Z^3-3*c^2
*b*_Z))-1/36*I/d/a^2/b^2*c^2*sum((-2*I*b*_R1*c^2-4*I*b*_R1^2-2*I*b*c^2+_R1
^2*b*c+a*d^3-c^3*b-4*I*_R1*b-2*b*c*_R1+6*c*b)/(2*I*c*_R1-_R1^2+c^2)*exp(-_
R1)*Ei(1,I*d*x+I*c-_R1),_R1=RootOf(-3*I*_Z^2*b*c-I*d^3*a+I*b*c^3+b*_Z^3-3*
c^2*b*_Z))-1/36*I/d/a^2/b^2*c*sum((I*_R1*a*d^3+2*I*_R1*b*c^3+8*I*_R1^2*b*c
+2*I*a*d^3-2*I*b*c^3-_R1^2*b*c^2-a*c*d^3+b*c^4+8*I*_R1*b*c+10*_R1*b*c^2...
```

### 3.109.5 Fricas [C] (verification not implemented)

Result contains complex when optimal does not.

Time = 0.33 (sec) , antiderivative size = 890, normalized size of antiderivative = 1.15

$$\int \frac{x^3 \sin(c+dx)}{(a+bx^3)^3} \, dx = \text{Too large to display}$$

input
```
integrate(x^3*sin(d*x+c)/(b*x^3+a)^3,x, algorithm="fricas")
```

output
```
1/108*((I*a*b^2*d^3*x^6 + 2*I*a^2*b*d^3*x^3 + I*a^3*d^3 + (b^3*x^6 + 2*a*b
^2*x^3 + a^2*b + sqrt(3)*(I*b^3*x^6 + 2*I*a*b^2*x^3 + I*a^2*b))*(I*a*d^3/b
)^(1/3))*Ei(-I*d*x + 1/2*(I*a*d^3/b)^(1/3)*(-I*sqrt(3) - 1))*e^(1/2*(I*a*d
^3/b)^(1/3)*(I*sqrt(3) + 1) - I*c) + (-I*a*b^2*d^3*x^6 - 2*I*a^2*b*d^3*x^3
 - I*a^3*d^3 + (b^3*x^6 + 2*a*b^2*x^3 + a^2*b + sqrt(3)*(I*b^3*x^6 + 2*I*a
*b^2*x^3 + I*a^2*b))*(-I*a*d^3/b)^(1/3))*Ei(I*d*x + 1/2*(-I*a*d^3/b)^(1/3)
*(-I*sqrt(3) - 1))*e^(1/2*(-I*a*d^3/b)^(1/3)*(I*sqrt(3) + 1) + I*c) + (I*a
*b^2*d^3*x^6 + 2*I*a^2*b*d^3*x^3 + I*a^3*d^3 + (b^3*x^6 + 2*a*b^2*x^3 + a^
2*b + sqrt(3)*(-I*b^3*x^6 - 2*I*a*b^2*x^3 - I*a^2*b))*(I*a*d^3/b)^(1/3))*E
i(-I*d*x + 1/2*(I*a*d^3/b)^(1/3)*(I*sqrt(3) - 1))*e^(1/2*(I*a*d^3/b)^(1/3)
*(-I*sqrt(3) + 1) - I*c) + (-I*a*b^2*d^3*x^6 - 2*I*a^2*b*d^3*x^3 - I*a^3*d
^3 + (b^3*x^6 + 2*a*b^2*x^3 + a^2*b + sqrt(3)*(-I*b^3*x^6 - 2*I*a*b^2*x^3
- I*a^2*b))*(-I*a*d^3/b)^(1/3))*Ei(I*d*x + 1/2*(-I*a*d^3/b)^(1/3)*(I*sqrt(
3) - 1))*e^(1/2*(-I*a*d^3/b)^(1/3)*(-I*sqrt(3) + 1) + I*c) + (-I*a*b^2*d^3
*x^6 - 2*I*a^2*b*d^3*x^3 - I*a^3*d^3 - 2*(b^3*x^6 + 2*a*b^2*x^3 + a^2*b)*(
-I*a*d^3/b)^(1/3))*Ei(I*d*x + (-I*a*d^3/b)^(1/3))*e^(I*c - (-I*a*d^3/b)^(1
/3)) + (I*a*b^2*d^3*x^6 + 2*I*a^2*b*d^3*x^3 + I*a^3*d^3 - 2*(b^3*x^6 + 2*a
*b^2*x^3 + a^2*b)*(I*a*d^3/b)^(1/3))*Ei(-I*d*x + (I*a*d^3/b)^(1/3))*e^(-I*
c - (I*a*d^3/b)^(1/3)) + 6*(a*b^2*d^2*x^5 + a^2*b*d^2*x^2)*cos(d*x + c) +
6*(a*b^2*d*x^4 - 2*a^2*b*d*x)*sin(d*x + c))/(a^2*b^4*d*x^6 + 2*a^3*b^3*...
```

## 3.109.6 Sympy [F(-1)]

Timed out.

$$\int \frac{x^3 \sin(c+dx)}{(a+bx^3)^3} \, dx = \text{Timed out}$$

input
```
integrate(x**3*sin(d*x+c)/(b*x**3+a)**3,x)
```

output
```
Timed out
```

### 3.109.7 Maxima [F]

$$\int \frac{x^3 \sin(c+dx)}{(a+bx^3)^3} \, dx = \int \frac{x^3 \sin(dx+c)}{(bx^3+a)^3} \, dx$$

input
```
integrate(x^3*sin(d*x+c)/(b*x^3+a)^3,x, algorithm="maxima")
```

output
```
-1/2*(6*(cos(c)^2 + sin(c)^2)*d*x^2*sin(d*x + c) + ((d^2*x^3*cos(c) - 6*d*
x^2*sin(c) - 42*x*cos(c))*cos(d*x + c)^2 + (d^2*x^3*cos(c) - 6*d*x^2*sin(c
) - 42*x*cos(c))*sin(d*x + c)^2)*cos(d*x + 2*c) + ((cos(c)^2 + sin(c)^2)*d
^2*x^3 - 42*(cos(c)^2 + sin(c)^2)*x)*cos(d*x + c) - 2*(((b^3*cos(c)^2 + b^
3*sin(c)^2)*d^3*x^9 + 3*(a*b^2*cos(c)^2 + a*b^2*sin(c)^2)*d^3*x^6 + 3*(a^2
*b*cos(c)^2 + a^2*b*sin(c)^2)*d^3*x^3 + (a^3*cos(c)^2 + a^3*sin(c)^2)*d^3)
*cos(d*x + c)^2 + ((b^3*cos(c)^2 + b^3*sin(c)^2)*d^3*x^9 + 3*(a*b^2*cos(c)
^2 + a*b^2*sin(c)^2)*d^3*x^6 + 3*(a^2*b*cos(c)^2 + a^2*b*sin(c)^2)*d^3*x^3
 + (a^3*cos(c)^2 + a^3*sin(c)^2)*d^3)*sin(d*x + c)^2)*integrate(3/2*(18*a*
d*x*sin(d*x + c) + (3*a*d^2*x^2 + 112*b*x^3 - 14*a)*cos(d*x + c))/(b^4*d^3
*x^12 + 4*a*b^3*d^3*x^9 + 6*a^2*b^2*d^3*x^6 + 4*a^3*b*d^3*x^3 + a^4*d^3),
x) - 2*(((b^3*cos(c)^2 + b^3*sin(c)^2)*d^3*x^9 + 3*(a*b^2*cos(c)^2 + a*b^2
*sin(c)^2)*d^3*x^6 + 3*(a^2*b*cos(c)^2 + a^2*b*sin(c)^2)*d^3*x^3 + (a^3*co
s(c)^2 + a^3*sin(c)^2)*d^3)*cos(d*x + c)^2 + ((b^3*cos(c)^2 + b^3*sin(c)^2
)*d^3*x^9 + 3*(a*b^2*cos(c)^2 + a*b^2*sin(c)^2)*d^3*x^6 + 3*(a^2*b*cos(c)^
2 + a^2*b*sin(c)^2)*d^3*x^3 + (a^3*cos(c)^2 + a^3*sin(c)^2)*d^3)*sin(d*x +
 c)^2)*integrate(3/2*(18*a*d*x*sin(d*x + c) + (3*a*d^2*x^2 + 112*b*x^3 - 1
4*a)*cos(d*x + c))/((b^4*d^3*x^12 + 4*a*b^3*d^3*x^9 + 6*a^2*b^2*d^3*x^6 +
4*a^3*b*d^3*x^3 + a^4*d^3)*cos(d*x + c)^2 + (b^4*d^3*x^12 + 4*a*b^3*d^3*x^
9 + 6*a^2*b^2*d^3*x^6 + 4*a^3*b*d^3*x^3 + a^4*d^3)*sin(d*x + c)^2), x) ...
```

### 3.109.8 Giac [F]

$$\int \frac{x^3 \sin(c+dx)}{(a+bx^3)^3} \, dx = \int \frac{x^3 \sin(dx+c)}{(bx^3+a)^3} \, dx$$

input
```
integrate(x^3*sin(d*x+c)/(b*x^3+a)^3,x, algorithm="giac")
```

output
```
integrate(x^3*sin(d*x + c)/(b*x^3 + a)^3, x)
```

### 3.109.9 Mupad [F(-1)]

Timed out.

$$\int \frac{x^3 \sin(c+dx)}{(a+bx^3)^3}\,dx = \int \frac{x^3\,\sin\left(c+d\,x\right)}{\left(b\,x^3+a\right)^3}\,dx$$

input
```
int((x^3*sin(c + d*x))/(a + b*x^3)^3,x)
```

output
```
int((x^3*sin(c + d*x))/(a + b*x^3)^3, x)
```

# 3.110 $\int \frac{x^2 \sin(c+dx)}{(a+bx^3)^3} \, dx$

### 3.110.1 Optimal result

Integrand size = 19, antiderivative size = 777

$$\int \frac{x^2\sin(c+dx)}{(a+bx^3)^3}\,dx = \frac{d\cos(c+dx)}{18ab^2x^2} - \frac{d\cos(c+dx)}{18b^2x^2(a+bx^3)} - \frac{\sqrt[3]{-1}d\cos\left(c+\frac{\sqrt[3]{-1}\sqrt[3]{a}d}{\sqrt[3]{b}}\right)\text{CosIntegral}\left(\frac{\sqrt[3]{-1}\sqrt[3]{a}d}{\sqrt[3]{b}}-dx\right)}{27a^{5/3}b^{4/3}} + \frac{d\cos\left(c-\frac{\sqrt[3]{a}d}{\sqrt[3]{b}}\right)\text{CosIntegral}\left(\frac{\sqrt[3]{a}d}{\sqrt[3]{b}}+dx\right)}{27a^{5/3}b^{4/3}} + \frac{(-1)^{2/3}d\cos\left(c-\frac{(-1)^{2/3}\sqrt[3]{a}d}{\sqrt[3]{b}}\right)\text{CosIntegral}\left(\frac{(-1)^{2/3}\sqrt[3]{a}d}{\sqrt[3]{b}}+dx\right)}{27a^{5/3}b^{4/3}} - \frac{d^2\,\text{CosIntegral}\left(\frac{\sqrt[3]{a}d}{\sqrt[3]{b}}+dx\right)\sin\left(c-\frac{\sqrt[3]{a}d}{\sqrt[3]{b}}\right)}{54a^{4/3}b^{5/3}} - \frac{(-1)^{2/3}d^2\,\text{CosIntegral}\left(\frac{\sqrt[3]{-1}\sqrt[3]{a}d}{\sqrt[3]{b}}-dx\right)\sin\left(c+\frac{\sqrt[3]{-1}\sqrt[3]{a}d}{\sqrt[3]{b}}\right)}{54a^{4/3}b^{5/3}} + \frac{\sqrt[3]{-1}d^2\,\text{CosIntegral}\left(\frac{(-1)^{2/3}\sqrt[3]{a}d}{\sqrt[3]{b}}+dx\right)\sin\left(c-\frac{(-1)^{2/3}\sqrt[3]{a}d}{\sqrt[3]{b}}\right)}{54a^{4/3}b^{5/3}} - \frac{\sin(c+dx)}{6b(a+bx^3)^2} + \frac{(-1)^{2/3}d^2\cos\left(c+\frac{\sqrt[3]{-1}\sqrt[3]{a}d}{\sqrt[3]{b}}\right)\text{Si}\left(\frac{\sqrt[3]{-1}\sqrt[3]{a}d}{\sqrt[3]{b}}-dx\right)}{54a^{4/3}b^{5/3}} - \frac{\sqrt[3]{-1}d\sin\left(c+\frac{\sqrt[3]{-1}\sqrt[3]{a}d}{\sqrt[3]{b}}\right)\text{Si}\left(\frac{\sqrt[3]{-1}\sqrt[3]{a}d}{\sqrt[3]{b}}-dx\right)}{27a^{5/3}b^{4/3}} - \frac{d^2\cos\left(c-\frac{\sqrt[3]{a}d}{\sqrt[3]{b}}\right)\text{Si}\left(\frac{\sqrt[3]{a}d}{\sqrt[3]{b}}+dx\right)}{54a^{4/3}b^{5/3}} - \frac{d\sin\left(c-\frac{\sqrt[3]{a}d}{\sqrt[3]{b}}\right)\text{Si}\left(\frac{\sqrt[3]{a}d}{\sqrt[3]{b}}+dx\right)}{27a^{5/3}b^{4/3}} + \frac{\sqrt[3]{-1}d^2\cos\left(c-\frac{(-1)^{2/3}\sqrt[3]{a}d}{\sqrt[3]{b}}\right)\text{Si}\left(\frac{(-1)^{2/3}\sqrt[3]{a}d}{\sqrt[3]{b}}+dx\right)}{54a^{4/3}b^{5/3}} - \frac{(-1)^{2/3}d\sin\left(c-\frac{(-1)^{2/3}\sqrt[3]{a}d}{\sqrt[3]{b}}\right)\text{Si}\left(\frac{(-1)^{2/3}\sqrt[3]{a}d}{\sqrt[3]{b}}+dx\right)}{27a^{5/3}b^{4/3}}$$

output
```
1/27*d*Ci(a^(1/3)*d/b^(1/3)+d*x)*cos(c-a^(1/3)*d/b^(1/3))/a^(5/3)/b^(4/3)-
1/27*(-1)^(1/3)*d*Ci((-1)^(1/3)*a^(1/3)*d/b^(1/3)-d*x)*cos(c+(-1)^(1/3)*a^
(1/3)*d/b^(1/3))/a^(5/3)/b^(4/3)+1/27*(-1)^(2/3)*d*Ci((-1)^(2/3)*a^(1/3)*d
/b^(1/3)+d*x)*cos(c-(-1)^(2/3)*a^(1/3)*d/b^(1/3))/a^(5/3)/b^(4/3)+1/18*d*c
os(d*x+c)/a/b^2/x^2-1/18*d*cos(d*x+c)/b^2/x^2/(b*x^3+a)-1/54*(-1)^(2/3)*d^
2*cos(c+(-1)^(1/3)*a^(1/3)*d/b^(1/3))*Si(-(-1)^(1/3)*a^(1/3)*d/b^(1/3)+d*x
)/a^(4/3)/b^(5/3)-1/54*d^2*cos(c-a^(1/3)*d/b^(1/3))*Si(a^(1/3)*d/b^(1/3)+d
*x)/a^(4/3)/b^(5/3)+1/54*(-1)^(1/3)*d^2*cos(c-(-1)^(2/3)*a^(1/3)*d/b^(1/3)
)*Si((-1)^(2/3)*a^(1/3)*d/b^(1/3)+d*x)/a^(4/3)/b^(5/3)-1/54*d^2*Ci(a^(1/3)
*d/b^(1/3)+d*x)*sin(c-a^(1/3)*d/b^(1/3))/a^(4/3)/b^(5/3)-1/27*d*Si(a^(1/3)
*d/b^(1/3)+d*x)*sin(c-a^(1/3)*d/b^(1/3))/a^(5/3)/b^(4/3)-1/54*(-1)^(2/3)*d
^2*Ci((-1)^(1/3)*a^(1/3)*d/b^(1/3)-d*x)*sin(c+(-1)^(1/3)*a^(1/3)*d/b^(1/3)
)/a^(4/3)/b^(5/3)+1/27*(-1)^(1/3)*d*Si(-(-1)^(1/3)*a^(1/3)*d/b^(1/3)+d*x)*
sin(c+(-1)^(1/3)*a^(1/3)*d/b^(1/3))/a^(5/3)/b^(4/3)+1/54*(-1)^(1/3)*d^2*Ci
((-1)^(2/3)*a^(1/3)*d/b^(1/3)+d*x)*sin(c-(-1)^(2/3)*a^(1/3)*d/b^(1/3))/a^(
4/3)/b^(5/3)-1/27*(-1)^(2/3)*d*Si((-1)^(2/3)*a^(1/3)*d/b^(1/3)+d*x)*sin(c-
(-1)^(2/3)*a^(1/3)*d/b^(1/3))/a^(5/3)/b^(4/3)-1/6*sin(d*x+c)/b/(b*x^3+a)^2
```

### 3.110.2 Mathematica [C] (verified)

Result contains higher order function than in optimal. Order 9 vs. order 4 in optimal.

Time = 0.31 (sec) , antiderivative size = 449, normalized size of antiderivative = 0.58

$$\int \frac{x^2 \sin(c+dx)}{(a+bx^3)^3}\,dx$$
$$= \frac{id\text{RootSum}\left[a+b\#1^3\&, \frac{-2i\cos(c+d\#1)\,\text{CosIntegral}(d(x-\#1))-2\,\text{CosIntegral}(d(x-\#1))\sin(c+d\#1)-2\cos(c+d\#1)\text{Si}(d(x-\#1))}{}\right.}{}$$

input
```
Integrate[(x^2*Sin[c + d*x])/(a + b*x^3)^3,x]
```

output
```
(I*d*RootSum[a + b*#1^3 & , ((-2*I)*Cos[c + d*#1]*CosIntegral[d*(x - #1)]
- 2*CosIntegral[d*(x - #1)]*Sin[c + d*#1] - 2*Cos[c + d*#1]*SinIntegral[d*
(x - #1)] + (2*I)*Sin[c + d*#1]*SinIntegral[d*(x - #1)] + d*Cos[c + d*#1]*
CosIntegral[d*(x - #1)]*#1 - I*d*CosIntegral[d*(x - #1)]*Sin[c + d*#1]*#1
- I*d*Cos[c + d*#1]*SinIntegral[d*(x - #1)]*#1 - d*Sin[c + d*#1]*SinIntegr
al[d*(x - #1)]*#1)/#1^2 & ] - I*d*RootSum[a + b*#1^3 & , ((2*I)*Cos[c + d*
#1]*CosIntegral[d*(x - #1)] - 2*CosIntegral[d*(x - #1)]*Sin[c + d*#1] - 2*
Cos[c + d*#1]*SinIntegral[d*(x - #1)] - (2*I)*Sin[c + d*#1]*SinIntegral[d*
(x - #1)] + d*Cos[c + d*#1]*CosIntegral[d*(x - #1)]*#1 + I*d*CosIntegral[d
*(x - #1)]*Sin[c + d*#1]*#1 + I*d*Cos[c + d*#1]*SinIntegral[d*(x - #1)]*#1
 - d*Sin[c + d*#1]*SinIntegral[d*(x - #1)]*#1)/#1^2 & ] + (6*b*Cos[d*x]*(d
*x*(a + b*x^3)*Cos[c] - 3*a*Sin[c]))/(a + b*x^3)^2 - (6*b*(3*a*Cos[c] + d*
x*(a + b*x^3)*Sin[c])*Sin[d*x])/(a + b*x^3)^2)/(108*a*b^2)
```

### 3.110.3 Rubi [A] (verified)

Time = 1.95 (sec) , antiderivative size = 860, normalized size of antiderivative = 1.11, number of steps used = 6, number of rules used = 6, $\frac{\text{number of rules}}{\text{integrand size}}$ = 0.316, Rules used = {3822, 3813, 3826, 2009, 3827, 2009}

Below are the steps used by Rubi to obtain the solution. The rule number used for the transformation is given above next to the arrow. The rules definitions used are listed below.

$$\int \frac{x^2 \sin(c+dx)}{(a+bx^3)^3}dx$$

$$\Big\downarrow \text{3822}$$

$$\frac{d\int \frac{\cos(c+dx)}{(bx^3+a)^2}dx}{6b}-\frac{\sin(c+dx)}{6b(a+bx^3)^2}$$

$$\Big\downarrow \text{3813}$$

$$\frac{d\left(-\frac{2\int \frac{\cos(c+dx)}{x^3\left(bx^3+a\right)}dx}{3b}-\frac{d\int \frac{\sin(c+dx)}{x^2\left(bx^3+a\right)}dx}{3b}-\frac{\cos(c+dx)}{3bx^2(a+bx^3)}\right)}{6b}-\frac{\sin(c+dx)}{6b(a+bx^3)^2}$$

$$\Big\downarrow \text{3826}$$

$$\frac{d\left(-\frac{2\int \frac{\cos(c+dx)}{x^3\left(bx^3+a\right)}dx}{3b}-\frac{d\int \left(\frac{\sin(c+dx)}{ax^2}-\frac{bx\sin(c+dx)}{a\left(bx^3+a\right)}\right)dx}{3b}-\frac{\cos(c+dx)}{3bx^2(a+bx^3)}\right)}{6b}-\frac{\sin(c+dx)}{6b(a+bx^3)^2}$$

$\Big\downarrow$ 2009

$$d\left(-\frac{2\int \frac{\cos(c+dx)}{x^3\left(bx^3+a\right)}dx}{3b}-\frac{d\left(\frac{\sqrt[3]{b}\sin\left(c-\frac{\sqrt[3]{a}d}{\sqrt[3]{b}}\right)\text{CosIntegral}\left(xd+\frac{\sqrt[3]{a}d}{\sqrt[3]{b}}\right)}{3a^{4/3}}+\frac{(-1)^{2/3}\sqrt[3]{b}\sin\left(\frac{\sqrt[3]{-1}\sqrt[3]{a}d}{\sqrt[3]{b}}+c\right)\text{CosIntegral}\left(\frac{\sqrt[3]{-1}\sqrt[3]{a}d}{\sqrt[3]{b}}-dx\right)}{3a^{4/3}}-\cdots\right.}{\cdots}\right.$$

$$\frac{\sin(c+dx)}{6b\left(a+bx^3\right)^2}$$

$\Big\downarrow$ 3827

$$d\left(-\frac{2\int\left(\frac{\cos(c+dx)}{ax^3}-\frac{b\cos(c+dx)}{a\left(bx^3+a\right)}\right)dx}{3b}-\frac{d\left(\frac{\sqrt[3]{b}\sin\left(c-\frac{\sqrt[3]{a}d}{\sqrt[3]{b}}\right)\text{CosIntegral}\left(xd+\frac{\sqrt[3]{a}d}{\sqrt[3]{b}}\right)}{3a^{4/3}}+\frac{(-1)^{2/3}\sqrt[3]{b}\sin\left(\frac{\sqrt[3]{-1}\sqrt[3]{a}d}{\sqrt[3]{b}}+c\right)\text{CosIntegral}\left(\frac{\sqrt[3]{-1}\cdots}{\sqrt[3]{b}\cdots}\right.}{3a^{4/3}}\cdots\right.}{\cdots}\right.$$

$$\frac{\sin(c+dx)}{6b\left(a+bx^3\right)^2}$$

$\Big\downarrow$ 2009

$$d\left(-\frac{\cos(c+dx)}{3bx^2(bx^3+a)}-\frac{d\left(\frac{d\cos(c)\,\text{CosIntegral}(dx)}{a}+\frac{\sqrt[3]{b}\,\text{CosIntegral}\left(xd+\frac{\sqrt[3]{a}d}{\sqrt[3]{b}}\right)\sin\left(c-\frac{\sqrt[3]{a}d}{\sqrt[3]{b}}\right)}{3a^{4/3}}+\frac{(-1)^{2/3}\sqrt[3]{b}\,\text{CosIntegral}\left(\frac{\sqrt[3]{-1}\sqrt[3]{a}d}{\sqrt[3]{b}}-dx\right)\sin\left(c+\cdots\right.}{3a^{4/3}}\cdots\right.}{\cdots}\right.$$

$$\frac{\sin(c+dx)}{6b\left(bx^3+a\right)^2}$$

input
```
Int[(x^2*Sin[c + d*x])/(a + b*x^3)^3,x]
```

3.110. $\int \frac{x^2\sin(c+dx)}{(a+bx^3)^3}\,dx$

output
```
-1/6*Sin[c + d*x]/(b*(a + b*x^3)^2) + (d*(-1/3*Cos[c + d*x]/(b*x^2*(a + b*
x^3)) - (d*((d*Cos[c]*CosIntegral[d*x])/a + (b^(1/3)*CosIntegral[(a^(1/3)*
d)/b^(1/3) + d*x]*Sin[c - (a^(1/3)*d)/b^(1/3)])/(3*a^(4/3)) + ((-1)^(2/3)*
b^(1/3)*CosIntegral[((-1)^(1/3)*a^(1/3)*d)/b^(1/3) - d*x]*Sin[c + ((-1)^(1
/3)*a^(1/3)*d)/b^(1/3)])/(3*a^(4/3)) - ((-1)^(1/3)*b^(1/3)*CosIntegral[((-
1)^(2/3)*a^(1/3)*d)/b^(1/3) + d*x]*Sin[c - ((-1)^(2/3)*a^(1/3)*d)/b^(1/3)]
)/(3*a^(4/3)) - Sin[c + d*x]/(a*x) - (d*Sin[c]*SinIntegral[d*x])/a - ((-1)
^(2/3)*b^(1/3)*Cos[c + ((-1)^(1/3)*a^(1/3)*d)/b^(1/3)]*SinIntegral[((-1)^(
1/3)*a^(1/3)*d)/b^(1/3) - d*x])/(3*a^(4/3)) + (b^(1/3)*Cos[c - (a^(1/3)*d)
/b^(1/3)]*SinIntegral[(a^(1/3)*d)/b^(1/3) + d*x])/(3*a^(4/3)) - ((-1)^(1/3
)*b^(1/3)*Cos[c - ((-1)^(2/3)*a^(1/3)*d)/b^(1/3)]*SinIntegral[((-1)^(2/3)*
a^(1/3)*d)/b^(1/3) + d*x])/(3*a^(4/3))))/(3*b) - (2*(-1/2*Cos[c + d*x]/(a*
x^2) - (d^2*Cos[c]*CosIntegral[d*x])/(2*a) + ((-1)^(1/3)*b^(2/3)*Cos[c + (
(-1)^(1/3)*a^(1/3)*d)/b^(1/3)]*CosIntegral[((-1)^(1/3)*a^(1/3)*d)/b^(1/3)
- d*x])/(3*a^(5/3)) - (b^(2/3)*Cos[c - (a^(1/3)*d)/b^(1/3)]*CosIntegral[(a
^(1/3)*d)/b^(1/3) + d*x])/(3*a^(5/3)) - ((-1)^(2/3)*b^(2/3)*Cos[c - ((-1)^
(2/3)*a^(1/3)*d)/b^(1/3)]*CosIntegral[((-1)^(2/3)*a^(1/3)*d)/b^(1/3) + d*x
])/(3*a^(5/3)) + (d*Sin[c + d*x])/(2*a*x) + (d^2*Sin[c]*SinIntegral[d*x])/
(2*a) + ((-1)^(1/3)*b^(2/3)*Sin[c + ((-1)^(1/3)*a^(1/3)*d)/b^(1/3)]*SinInt
egral[((-1)^(1/3)*a^(1/3)*d)/b^(1/3) - d*x])/(3*a^(5/3)) + (b^(2/3)*Sin...
```

### 3.110.3.1 Defintions of rubi rules used

rule 2009
```
Int[u_, x_Symbol] :> Simp[IntSum[u, x], x] /; SumQ[u]
```

rule 3813
```
Int[Cos[(c_.) + (d_.)*(x_)]*((a_) + (b_.)*(x_)^(n_))^(p_), x_Symbol] :> Sim
p[x^(-n + 1)*(a + b*x^n)^(p + 1)*(Cos[c + d*x]/(b*n*(p + 1))), x] + (-Simp[
(-n + 1)/(b*n*(p + 1))   Int[((a + b*x^n)^(p + 1)*Cos[c + d*x])/x^n, x], x]
 + Simp[d/(b*n*(p + 1))   Int[x^(-n + 1)*(a + b*x^n)^(p + 1)*Sin[c + d*x],
x], x]) /; FreeQ[{a, b, c, d}, x] && ILtQ[p, -1] && IGtQ[n, 2]
```

rule 3822
```
Int[((e_.)*(x_))^(m_.)*((a_) + (b_.)*(x_)^(n_))^(p_)*Sin[(c_.) + (d_.)*(x_)
], x_Symbol] :> Simp[e^m*(a + b*x^n)^(p + 1)*(Sin[c + d*x]/(b*n*(p + 1))),
x] - Simp[d*(e^m/(b*n*(p + 1)))   Int[(a + b*x^n)^(p + 1)*Cos[c + d*x], x],
 x] /; FreeQ[{a, b, c, d, e, m, n}, x] && ILtQ[p, -1] && EqQ[m, n - 1] && (
IntegerQ[n] || GtQ[e, 0])
```

## 3.110. $\int \frac{x^2 \sin(c+dx)}{(a+bx^3)^3} \, dx$

rule 3826
```
Int[(x_)^(m_.)*((a_) + (b_.)*(x_)^(n_))^(p_)*Sin[(c_.) + (d_.)*(x_)], x_Sym
bol] :> Int[ExpandIntegrand[Sin[c + d*x], x^m*(a + b*x^n)^p, x], x] /; Free
Q[{a, b, c, d, m}, x] && ILtQ[p, 0] && IGtQ[n, 0] && (EqQ[n, 2] || EqQ[p, -
1]) && IntegerQ[m]
```

rule 3827
```
Int[Cos[(c_.) + (d_.)*(x_)]*(x_)^(m_.)*((a_) + (b_.)*(x_)^(n_))^(p_), x_Sym
bol] :> Int[ExpandIntegrand[Cos[c + d*x], x^m*(a + b*x^n)^p, x], x] /; Free
Q[{a, b, c, d, m}, x] && ILtQ[p, 0] && IGtQ[n, 0] && (EqQ[n, 2] || EqQ[p, -
1]) && IntegerQ[m]
```

### 3.110.4 Maple [C] (verified)

Result contains higher order function than in optimal. Order 9 vs. order 4.

Time = 1.74 (sec) , antiderivative size = 918, normalized size of antiderivative = 1.18

| method | result | size |
|---|---|---|
| risch | Expression too large to display | 918 |
| derivativedivides | Expression too large to display | 1396 |
| default | Expression too large to display | 1396 |

input
```
int(x^2*sin(d*x+c)/(b*x^3+a)^3,x,method=_RETURNVERBOSE)
```

output
```
-1/108*I/a^2/b*c^2*sum((-2*I*c*_R1+6*I*c+_R1^2-c^2-6*_R1+10)/(-2*I*c*_R1+_
R1^2-c^2)*exp(_R1)*Ei(1,_R1-I*d*x-I*c),_R1=RootOf(-3*I*_Z^2*b*c-I*d^3*a+I*
b*c^3+b*_Z^3-3*c^2*b*_Z))-1/54*I/a^2/b^2*c*sum((-2*I*b*_R1*c^2+4*I*b*_R1^2
+2*I*b*c^2+_R1^2*b*c+a*d^3-c^3*b-4*I*_R1*b+2*b*c*_R1+6*c*b)/(2*I*c*_R1-_R1
^2+c^2)*exp(_R1)*Ei(1,_R1-I*d*x-I*c),_R1=RootOf(-3*I*_Z^2*b*c-I*d^3*a+I*b*
c^3+b*_Z^3-3*c^2*b*_Z))-1/108*I/a^2/b^2*sum((I*_R1*a*d^3+2*I*_R1*b*c^3-8*I
*_R1^2*b*c-2*I*a*d^3+2*I*b*c^3-_R1^2*b*c^2-a*c*d^3+b*c^4+8*I*_R1*b*c-10*_R
1*b*c^2-2*c^2*b)/(2*I*c*_R1-_R1^2+c^2)*exp(_R1)*Ei(1,_R1-I*d*x-I*c),_R1=Ro
otOf(-3*I*_Z^2*b*c-I*d^3*a+I*b*c^3+b*_Z^3-3*c^2*b*_Z))+1/108*I/a^2/b*c^2*s
um((-2*I*c*_R1-6*I*c+_R1^2-c^2+6*_R1+10)/(-2*I*c*_R1+_R1^2-c^2)*exp(-_R1)*
Ei(1,I*d*x+I*c-_R1),_R1=RootOf(-3*I*_Z^2*b*c-I*d^3*a+I*b*c^3+b*_Z^3-3*c^2*
b*_Z))+1/54*I/a^2/b^2*c*sum((-2*I*b*_R1*c^2-4*I*b*_R1^2-2*I*b*c^2+_R1^2*b*
c+a*d^3-c^3*b-4*I*_R1*b-2*b*c*_R1+6*c*b)/(2*I*c*_R1-_R1^2+c^2)*exp(-_R1)*E
i(1,I*d*x+I*c-_R1),_R1=RootOf(-3*I*_Z^2*b*c-I*d^3*a+I*b*c^3+b*_Z^3-3*c^2*b
*_Z))+1/108*I/a^2/b^2*sum((I*_R1*a*d^3+2*I*_R1*b*c^3+8*I*_R1^2*b*c+2*I*a*d
^3-2*I*b*c^3-_R1^2*b*c^2-a*c*d^3+b*c^4+8*I*_R1*b*c+10*_R1*b*c^2-2*c^2*b)/(
2*I*c*_R1-_R1^2+c^2)*exp(-_R1)*Ei(1,I*d*x+I*c-_R1),_R1=RootOf(-3*I*_Z^2*b*
c-I*d^3*a+I*b*c^3+b*_Z^3-3*c^2*b*_Z))+1/18*(a*b*d^7*x^4+a^2*d^7*x)/a^2/b/(
b^2*d^6*x^6+2*a*b*d^6*x^3+a^2*d^6)*cos(d*x+c)-1/6*d^6/b/(b^2*d^6*x^6+2*a*b
*d^6*x^3+a^2*d^6)*sin(d*x+c)
```

### 3.110.5 Fricas [C] (verification not implemented)

Result contains complex when optimal does not.

Time = 0.34 (sec) , antiderivative size = 935, normalized size of antiderivative = 1.20

$$\int \frac{x^2 \sin(c+dx)}{(a+bx^3)^3}\,dx = \text{Too large to display}$$

input
```
integrate(x^2*sin(d*x+c)/(b*x^3+a)^3,x, algorithm="fricas")
```

output
```
1/216*(((-I*b^2*x^6 - 2*I*a*b*x^3 - I*a^2 - sqrt(3)*(b^2*x^6 + 2*a*b*x^3 +
 a^2))*(I*a*d^3/b)^(2/3) - 2*(I*b^2*x^6 + 2*I*a*b*x^3 + I*a^2 - sqrt(3)*(b
^2*x^6 + 2*a*b*x^3 + a^2))*(I*a*d^3/b)^(1/3))*Ei(-I*d*x + 1/2*(I*a*d^3/b)^
(1/3)*(-I*sqrt(3) - 1))*e^(1/2*(I*a*d^3/b)^(1/3)*(I*sqrt(3) + 1) - I*c) +
((I*b^2*x^6 + 2*I*a*b*x^3 + I*a^2 + sqrt(3)*(b^2*x^6 + 2*a*b*x^3 + a^2))*(
-I*a*d^3/b)^(2/3) - 2*(-I*b^2*x^6 - 2*I*a*b*x^3 - I*a^2 + sqrt(3)*(b^2*x^6
 + 2*a*b*x^3 + a^2))*(-I*a*d^3/b)^(1/3))*Ei(I*d*x + 1/2*(-I*a*d^3/b)^(1/3)
*(-I*sqrt(3) - 1))*e^(1/2*(-I*a*d^3/b)^(1/3)*(I*sqrt(3) + 1) + I*c) + ((-I
*b^2*x^6 - 2*I*a*b*x^3 - I*a^2 + sqrt(3)*(b^2*x^6 + 2*a*b*x^3 + a^2))*(I*a
*d^3/b)^(2/3) - 2*(I*b^2*x^6 + 2*I*a*b*x^3 + I*a^2 + sqrt(3)*(b^2*x^6 + 2*
a*b*x^3 + a^2))*(I*a*d^3/b)^(1/3))*Ei(-I*d*x + 1/2*(I*a*d^3/b)^(1/3)*(I*sq
rt(3) - 1))*e^(1/2*(I*a*d^3/b)^(1/3)*(-I*sqrt(3) + 1) - I*c) + ((I*b^2*x^6
 + 2*I*a*b*x^3 + I*a^2 - sqrt(3)*(b^2*x^6 + 2*a*b*x^3 + a^2))*(-I*a*d^3/b)
^(2/3) - 2*(-I*b^2*x^6 - 2*I*a*b*x^3 - I*a^2 - sqrt(3)*(b^2*x^6 + 2*a*b*x^
3 + a^2))*(-I*a*d^3/b)^(1/3))*Ei(I*d*x + 1/2*(-I*a*d^3/b)^(1/3)*(I*sqrt(3)
 - 1))*e^(1/2*(-I*a*d^3/b)^(1/3)*(-I*sqrt(3) + 1) + I*c) - 2*((I*b^2*x^6 +
 2*I*a*b*x^3 + I*a^2)*(-I*a*d^3/b)^(2/3) + 2*(I*b^2*x^6 + 2*I*a*b*x^3 + I*
a^2)*(-I*a*d^3/b)^(1/3))*Ei(I*d*x + (-I*a*d^3/b)^(1/3))*e^(I*c - (-I*a*d^3
/b)^(1/3)) - 2*((-I*b^2*x^6 - 2*I*a*b*x^3 - I*a^2)*(I*a*d^3/b)^(2/3) + 2*(
-I*b^2*x^6 - 2*I*a*b*x^3 - I*a^2)*(I*a*d^3/b)^(1/3))*Ei(-I*d*x + (I*a*d...
```

### 3.110.6 Sympy [F(-1)]

Timed out.

$$\int \frac{x^2 \sin(c+dx)}{(a+bx^3)^3}\, dx = \text{Timed out}$$

input
```
integrate(x**2*sin(d*x+c)/(b*x**3+a)**3,x)
```

output
```
Timed out
```

### 3.110.7 Maxima [F]

$$\int \frac{x^2 \sin(c+dx)}{(a+bx^3)^3} dx = \int \frac{x^2 \sin(dx+c)}{(bx^3+a)^3} dx$$

input
```
integrate(x^2*sin(d*x+c)/(b*x^3+a)^3,x, algorithm="maxima")
```

output
```
-1/2*((cos(c)^2 + sin(c)^2)*d*x^2*cos(d*x + c) + 7*(cos(c)^2 + sin(c)^2)*x
*sin(d*x + c) + ((d*x^2*cos(c) - 7*x*sin(c))*cos(d*x + c)^2 + (d*x^2*cos(c
) - 7*x*sin(c))*sin(d*x + c)^2)*cos(d*x + 2*c) + 2*(((b^3*cos(c)^2 + b^3*s
in(c)^2)*d^2*x^9 + 3*(a*b^2*cos(c)^2 + a*b^2*sin(c)^2)*d^2*x^6 + 3*(a^2*b*
cos(c)^2 + a^2*b*sin(c)^2)*d^2*x^3 + (a^3*cos(c)^2 + a^3*sin(c)^2)*d^2)*co
s(d*x + c)^2 + ((b^3*cos(c)^2 + b^3*sin(c)^2)*d^2*x^9 + 3*(a*b^2*cos(c)^2
+ a*b^2*sin(c)^2)*d^2*x^6 + 3*(a^2*b*cos(c)^2 + a^2*b*sin(c)^2)*d^2*x^3 +
(a^3*cos(c)^2 + a^3*sin(c)^2)*d^2)*sin(d*x + c)^2)*integrate(-1/2*(9*a*d*x
*cos(d*x + c) - 7*(8*b*x^3 - a)*sin(d*x + c))/(b^4*d^2*x^12 + 4*a*b^3*d^2*
x^9 + 6*a^2*b^2*d^2*x^6 + 4*a^3*b*d^2*x^3 + a^4*d^2), x) + 2*(((b^3*cos(c)
^2 + b^3*sin(c)^2)*d^2*x^9 + 3*(a*b^2*cos(c)^2 + a*b^2*sin(c)^2)*d^2*x^6 +
 3*(a^2*b*cos(c)^2 + a^2*b*sin(c)^2)*d^2*x^3 + (a^3*cos(c)^2 + a^3*sin(c)^
2)*d^2)*cos(d*x + c)^2 + ((b^3*cos(c)^2 + b^3*sin(c)^2)*d^2*x^9 + 3*(a*b^2
*cos(c)^2 + a*b^2*sin(c)^2)*d^2*x^6 + 3*(a^2*b*cos(c)^2 + a^2*b*sin(c)^2)*
d^2*x^3 + (a^3*cos(c)^2 + a^3*sin(c)^2)*d^2)*sin(d*x + c)^2)*integrate(-1/
2*(9*a*d*x*cos(d*x + c) - 7*(8*b*x^3 - a)*sin(d*x + c))/((b^4*d^2*x^12 + 4
*a*b^3*d^2*x^9 + 6*a^2*b^2*d^2*x^6 + 4*a^3*b*d^2*x^3 + a^4*d^2)*cos(d*x +
c)^2 + (b^4*d^2*x^12 + 4*a*b^3*d^2*x^9 + 6*a^2*b^2*d^2*x^6 + 4*a^3*b*d^2*x
^3 + a^4*d^2)*sin(d*x + c)^2), x) + ((d*x^2*sin(c) + 7*x*cos(c))*cos(d*x +
 c)^2 + (d*x^2*sin(c) + 7*x*cos(c))*sin(d*x + c)^2)*sin(d*x + 2*c))/(((...
```

### 3.110.8 Giac [F]

$$\int \frac{x^2 \sin(c+dx)}{(a+bx^3)^3} dx = \int \frac{x^2 \sin(dx+c)}{(bx^3+a)^3} dx$$

input
```
integrate(x^2*sin(d*x+c)/(b*x^3+a)^3,x, algorithm="giac")
```

output
```
integrate(x^2*sin(d*x + c)/(b*x^3 + a)^3, x)
```

### 3.110.9 Mupad [F(-1)]

Timed out.

$$\int \frac{x^2 \sin(c+dx)}{(a+bx^3)^3} \, dx = \int \frac{x^2 \sin(c+d\,x)}{(b\,x^3+a)^3} \, dx$$

input
```
int((x^2*sin(c + d*x))/(a + b*x^3)^3,x)
```

output
```
int((x^2*sin(c + d*x))/(a + b*x^3)^3, x)
```

# 3.111 $\int \frac{x\sin(c+dx)}{(a+bx^3)^3}\,dx$



## 3.111.1 Optimal result

Integrand size = 17, antiderivative size = 1141

$$\int \frac{x\sin(c+dx)}{(a+bx^3)^3}\,dx = \text{Too large to display}$$

output
```
-2/27*d*Ci(a^(1/3)*d/b^(1/3)+d*x)*cos(c-a^(1/3)*d/b^(1/3))/a^2/b-2/27*d*Ci
((-1)^(1/3)*a^(1/3)*d/b^(1/3)-d*x)*cos(c+(-1)^(1/3)*a^(1/3)*d/b^(1/3))/a^2
/b-2/27*d*Ci((-1)^(2/3)*a^(1/3)*d/b^(1/3)+d*x)*cos(c-(-1)^(2/3)*a^(1/3)*d/
b^(1/3))/a^2/b+1/18*d*cos(d*x+c)/a/b^2/x^3-1/18*d*cos(d*x+c)/b^2/x^3/(b*x^
3+a)-2/27*(-1)^(2/3)*cos(c+(-1)^(1/3)*a^(1/3)*d/b^(1/3))*Si(-(-1)^(1/3)*a^
(1/3)*d/b^(1/3)+d*x)/a^(7/3)/b^(2/3)-1/54*(-1)^(1/3)*d^2*cos(c+(-1)^(1/3)*
a^(1/3)*d/b^(1/3))*Si(-(-1)^(1/3)*a^(1/3)*d/b^(1/3)+d*x)/a^(5/3)/b^(4/3)-2
/27*cos(c-a^(1/3)*d/b^(1/3))*Si(a^(1/3)*d/b^(1/3)+d*x)/a^(7/3)/b^(2/3)+1/5
4*d^2*cos(c-a^(1/3)*d/b^(1/3))*Si(a^(1/3)*d/b^(1/3)+d*x)/a^(5/3)/b^(4/3)+2
/27*(-1)^(1/3)*cos(c-(-1)^(2/3)*a^(1/3)*d/b^(1/3))*Si((-1)^(2/3)*a^(1/3)*d
/b^(1/3)+d*x)/a^(7/3)/b^(2/3)+1/54*(-1)^(2/3)*d^2*cos(c-(-1)^(2/3)*a^(1/3)
*d/b^(1/3))*Si((-1)^(2/3)*a^(1/3)*d/b^(1/3)+d*x)/a^(5/3)/b^(4/3)-2/27*Ci(a
^(1/3)*d/b^(1/3)+d*x)*sin(c-a^(1/3)*d/b^(1/3))/a^(7/3)/b^(2/3)+1/54*d^2*Ci
(a^(1/3)*d/b^(1/3)+d*x)*sin(c-a^(1/3)*d/b^(1/3))/a^(5/3)/b^(4/3)+2/27*d*Si
(a^(1/3)*d/b^(1/3)+d*x)*sin(c-a^(1/3)*d/b^(1/3))/a^2/b-2/27*(-1)^(2/3)*Ci(
(-1)^(1/3)*a^(1/3)*d/b^(1/3)-d*x)*sin(c+(-1)^(1/3)*a^(1/3)*d/b^(1/3))/a^(7
/3)/b^(2/3)-1/54*(-1)^(1/3)*d^2*Ci((-1)^(1/3)*a^(1/3)*d/b^(1/3)-d*x)*sin(c
+(-1)^(1/3)*a^(1/3)*d/b^(1/3))/a^(5/3)/b^(4/3)+2/27*d*Si(-(-1)^(1/3)*a^(1/
3)*d/b^(1/3)+d*x)*sin(c+(-1)^(1/3)*a^(1/3)*d/b^(1/3))/a^2/b+2/27*(-1)^(1/3
)*Ci((-1)^(2/3)*a^(1/3)*d/b^(1/3)+d*x)*sin(c-(-1)^(2/3)*a^(1/3)*d/b^(1/...
```

### 3.111.2 Mathematica [C] (warning: unable to verify)

Result contains higher order function than in optimal. Order 9 vs. order 4 in optimal.

Time = 0.41 (sec) , antiderivative size = 698, normalized size of antiderivative = 0.61

$$\int \frac{x\sin(c+dx)}{(a+bx^3)^3}\,dx = -\frac{\text{RootSum}\Big[a+b\#1^3\&,\frac{-iad^2\cos(c+d\#1)\,\text{CosIntegral}(d(x-\#1))-ad^2\,\text{CosIntegral}(d(x-\#1))\sin(c+d\#1)-ad^2\cos(c+d\#1)\text{S}}{}}{}$$

input
```
Integrate[(x*Sin[c + d*x])/(a + b*x^3)^3,x]
```

output
```
-1/108*(RootSum[a + b*#1^3 & , ((-I)*a*d^2*Cos[c + d*#1]*CosIntegral[d*(x
- #1)] - a*d^2*CosIntegral[d*(x - #1)]*Sin[c + d*#1] - a*d^2*Cos[c + d*#1]
*SinIntegral[d*(x - #1)] + I*a*d^2*Sin[c + d*#1]*SinIntegral[d*(x - #1)] -
 (4*I)*b*Cos[c + d*#1]*CosIntegral[d*(x - #1)]*#1 - 4*b*CosIntegral[d*(x -
 #1)]*Sin[c + d*#1]*#1 - 4*b*Cos[c + d*#1]*SinIntegral[d*(x - #1)]*#1 + (4
*I)*b*Sin[c + d*#1]*SinIntegral[d*(x - #1)]*#1 + 4*b*d*Cos[c + d*#1]*CosIn
tegral[d*(x - #1)]*#1^2 - (4*I)*b*d*CosIntegral[d*(x - #1)]*Sin[c + d*#1]*
#1^2 - (4*I)*b*d*Cos[c + d*#1]*SinIntegral[d*(x - #1)]*#1^2 - 4*b*d*Sin[c
+ d*#1]*SinIntegral[d*(x - #1)]*#1^2)/#1^2 & ] + RootSum[a + b*#1^3 & , (I
*a*d^2*Cos[c + d*#1]*CosIntegral[d*(x - #1)] - a*d^2*CosIntegral[d*(x - #1
)]*Sin[c + d*#1] - a*d^2*Cos[c + d*#1]*SinIntegral[d*(x - #1)] - I*a*d^2*S
in[c + d*#1]*SinIntegral[d*(x - #1)] + (4*I)*b*Cos[c + d*#1]*CosIntegral[d
*(x - #1)]*#1 - 4*b*CosIntegral[d*(x - #1)]*Sin[c + d*#1]*#1 - 4*b*Cos[c +
 d*#1]*SinIntegral[d*(x - #1)]*#1 - (4*I)*b*Sin[c + d*#1]*SinIntegral[d*(x
 - #1)]*#1 + 4*b*d*Cos[c + d*#1]*CosIntegral[d*(x - #1)]*#1^2 + (4*I)*b*d*
CosIntegral[d*(x - #1)]*Sin[c + d*#1]*#1^2 + (4*I)*b*d*Cos[c + d*#1]*SinIn
tegral[d*(x - #1)]*#1^2 - 4*b*d*Sin[c + d*#1]*SinIntegral[d*(x - #1)]*#1^2
)/#1^2 & ] - (6*b*Cos[d*x]*(a*d*(a + b*x^3)*Cos[c] + b*x^2*(7*a + 4*b*x^3)
*Sin[c]))/(a + b*x^3)^2 - (6*b*(b*x^2*(7*a + 4*b*x^3)*Cos[c] - a*d*(a + b*
x^3)*Sin[c])*Sin[d*x])/(a + b*x^3)^2)/(a^2*b^2)
```

### 3.111.3 Rubi [A] (verified)

Time = 3.98 (sec) , antiderivative size = 1802, normalized size of antiderivative = 1.58, number of steps used = 7, number of rules used = 7, $\frac{\text{number of rules}}{\text{integrand size}}$ = 0.412, Rules used = {3824, 3824, 3825, 3826, 2009, 3827, 2009}

Below are the steps used by Rubi to obtain the solution. The rule number used for the transformation is given above next to the arrow. The rules definitions used are listed below.

$$\int \frac{x \sin(c+dx)}{(a+bx^3)^3} \, dx$$

$$\Big\downarrow \text{3824}$$

$$\frac{d\int \frac{\cos(c+dx)}{x(bx^3+a)^2}dx}{6b}-\frac{\int \frac{\sin(c+dx)}{x^2(bx^3+a)^2}dx}{6b}-\frac{\sin(c+dx)}{6bx(a+bx^3)^2}$$

$$\Big\downarrow \text{3824}$$

$$\frac{d\int \frac{\cos(c+dx)}{x(bx^3+a)^2}dx}{6b}-\frac{-\frac{4\int \frac{\sin(c+dx)}{x^5\left(bx^3+a\right)}dx}{3b}+\frac{d\int \frac{\cos(c+dx)}{x^4\left(bx^3+a\right)}dx}{3b}-\frac{\sin(c+dx)}{3bx^4(a+bx^3)}}{6b}-\frac{\sin(c+dx)}{6bx(a+bx^3)^2}$$

$$\Big\downarrow \text{3825}$$

$$\frac{d\left(-\frac{d\int \frac{\sin(c+dx)}{x^3\left(bx^3+a\right)}dx}{3b}-\frac{\int \frac{\cos(c+dx)}{x^4\left(bx^3+a\right)}dx}{b}-\frac{\cos(c+dx)}{3bx^3(a+bx^3)}\right)}{6b}-\frac{-\frac{4\int \frac{\sin(c+dx)}{x^5\left(bx^3+a\right)}dx}{3b}+\frac{d\int \frac{\cos(c+dx)}{x^4\left(bx^3+a\right)}dx}{3b}-\frac{\sin(c+dx)}{3bx^4(a+bx^3)}}{6b}-\frac{\sin(c+dx)}{6bx(a+bx^3)^2}$$

$$\Big\downarrow \text{3826}$$

$$-\frac{-\frac{4\int \left(\frac{x\sin(c+dx)b^2}{a^2\left(bx^3+a\right)}-\frac{\sin(c+dx)b}{a^2x^2}+\frac{\sin(c+dx)}{ax^5}\right)dx}{3b}+\frac{d\int \frac{\cos(c+dx)}{x^4\left(bx^3+a\right)}dx}{3b}-\frac{\sin(c+dx)}{3bx^4(a+bx^3)}}{6b}+\frac{d\left(-\frac{d\int \left(\frac{\sin(c+dx)}{ax^3}-\frac{b\sin(c+dx)}{a\left(bx^3+a\right)}\right)dx}{3b}-\frac{\int \frac{\cos(c+dx)}{x^4\left(bx^3+a\right)}dx}{b}-\frac{\cos(c+dx)}{3bx^3(a+bx^3)}\right)}{6b}-\frac{\sin(c+dx)}{6bx(a+bx^3)^2}$$

$$\Big\downarrow \text{2009}$$

$$-\frac{\sin(c+dx)}{6bx\left(bx^3+a\right)^2}+\frac{d\left(-\frac{\cos(c+dx)}{3bx^3(bx^3+a)}-\frac{d\left(-\frac{\text{CosIntegral}(dx)\sin(c)d^2}{2a}-\frac{\cos(c)\text{Si}(dx)d^2}{2a}-\frac{\cos(c+dx)d}{2ax}-\frac{b^{2/3}\,\text{CosIntegral}\left(xd+\frac{\sqrt[3]{a}d}{\sqrt[3]{b}}\right)\sin\left(c-\frac{\sqrt[3]{a}d}{\sqrt[3]{b}}\right)}{3a^{5/3}}+\frac{\sqrt[3]{-1}b^{2/3}\,\text{CosInte}\cdots}{\cdots}\cdots\right)}{\cdots}\right)}{\cdots}$$

$$-\frac{\sin(c+dx)}{3bx^4(bx^3+a)}-\frac{4\left(\frac{\text{CosIntegral}(dx)\sin(c)d^4}{24a}+\frac{\cos(c)\text{Si}(dx)d^4}{24a}+\frac{\cos(c+dx)d^3}{24ax}+\frac{\sin(c+dx)d^2}{24ax^2}-\frac{\cos(c+dx)d}{12ax^3}-\frac{b\cos(c)\,\text{CosIntegral}(dx)d}{a^2}+\frac{b\sin(c)\text{Si}(dx)d}{a^2}-\cdots\right)}{\cdots}$$

$\downarrow$ 3827

$$-\frac{\sin(c+dx)}{6bx\left(bx^3+a\right)^2}+\frac{d\left(-\frac{\cos(c+dx)}{3bx^3(bx^3+a)}-\frac{d\left(-\frac{\text{CosIntegral}(dx)\sin(c)d^2}{2a}-\frac{\cos(c)\text{Si}(dx)d^2}{2a}-\frac{\cos(c+dx)d}{2ax}-\frac{b^{2/3}\,\text{CosIntegral}\left(xd+\frac{\sqrt[3]{a}d}{\sqrt[3]{b}}\right)\sin\left(c-\frac{\sqrt[3]{a}d}{\sqrt[3]{b}}\right)}{3a^{5/3}}+\frac{\sqrt[3]{-1}b^{2/3}\,\text{CosInte}\cdots}{\cdots}\cdots\right)}{\cdots}\right)}{\cdots}$$

$$-\frac{\sin(c+dx)}{3bx^4(bx^3+a)}-\frac{4\left(\frac{\text{CosIntegral}(dx)\sin(c)d^4}{24a}+\frac{\cos(c)\text{Si}(dx)d^4}{24a}+\frac{\cos(c+dx)d^3}{24ax}+\frac{\sin(c+dx)d^2}{24ax^2}-\frac{\cos(c+dx)d}{12ax^3}-\frac{b\cos(c)\,\text{CosIntegral}(dx)d}{a^2}+\frac{b\sin(c)\text{Si}(dx)d}{a^2}-\cdots\right)}{\cdots}$$

$\downarrow$ 2009

3.111. $\int \frac{x\sin(c+dx)}{(a+bx^3)^3}\,dx$

$$-\frac{\sin(c+dx)}{6bx\,(bx^3+a)^2}+$$

$$\frac{d\left(-\frac{\cos(c+dx)}{3bx^3(bx^3+a)}-\frac{d\left(-\frac{\text{CosIntegral}(dx)\sin(c)d^2}{2a}-\frac{\cos(c)\text{Si}(dx)d^2}{2a}-\frac{\cos(c+dx)d}{2ax}-\frac{b^{2/3}\,\text{CosIntegral}\left(xd+\frac{\sqrt[3]{a}d}{\sqrt[3]{b}}\right)\sin\left(c-\frac{\sqrt[3]{a}d}{\sqrt[3]{b}}\right)}{3a^{5/3}}+\frac{\sqrt[3]{-1}b^{2/3}\,\text{CosInte}\cdots}{\cdots}\cdots\right)}{\cdots}\cdots\right)}{\cdots}$$

$$-\frac{\sin(c+dx)}{3bx^4(bx^3+a)}-\frac{4\left(\frac{\text{CosIntegral}(dx)\sin(c)d^4}{24a}+\frac{\cos(c)\text{Si}(dx)d^4}{24a}+\frac{\cos(c+dx)d^3}{24ax}+\frac{\sin(c+dx)d^2}{24ax^2}-\frac{\cos(c+dx)d}{12ax^3}-\frac{b\cos(c)\,\text{CosIntegral}(dx)d}{a^2}+\frac{b\sin(c)\text{Si}(dx)d}{a^2}-\cdots\right)}{\cdots}$$

input
```
Int[(x*Sin[c + d*x])/(a + b*x^3)^3,x]
```

output
```
-1/6*Sin[c + d*x]/(b*x*(a + b*x^3)^2) + (d*(-1/3*Cos[c + d*x]/(b*x^3*(a +
b*x^3)) - (d*(-1/2*(d*Cos[c + d*x])/(a*x) - (d^2*CosIntegral[d*x]*Sin[c])/
(2*a) - (b^(2/3)*CosIntegral[(a^(1/3)*d)/b^(1/3) + d*x]*Sin[c - (a^(1/3)*d
)/b^(1/3)])/(3*a^(5/3)) + ((-1)^(1/3)*b^(2/3)*CosIntegral[((-1)^(1/3)*a^(1
/3)*d)/b^(1/3) - d*x]*Sin[c + ((-1)^(1/3)*a^(1/3)*d)/b^(1/3)])/(3*a^(5/3))
 - ((-1)^(2/3)*b^(2/3)*CosIntegral[((-1)^(2/3)*a^(1/3)*d)/b^(1/3) + d*x]*S
in[c - ((-1)^(2/3)*a^(1/3)*d)/b^(1/3)])/(3*a^(5/3)) - Sin[c + d*x]/(2*a*x^
2) - (d^2*Cos[c]*SinIntegral[d*x])/(2*a) - ((-1)^(1/3)*b^(2/3)*Cos[c + ((-
1)^(1/3)*a^(1/3)*d)/b^(1/3)]*SinIntegral[((-1)^(1/3)*a^(1/3)*d)/b^(1/3) -
d*x])/(3*a^(5/3)) - (b^(2/3)*Cos[c - (a^(1/3)*d)/b^(1/3)]*SinIntegral[(a^(
1/3)*d)/b^(1/3) + d*x])/(3*a^(5/3)) - ((-1)^(2/3)*b^(2/3)*Cos[c - ((-1)^(2
/3)*a^(1/3)*d)/b^(1/3)]*SinIntegral[((-1)^(2/3)*a^(1/3)*d)/b^(1/3) + d*x])
/(3*a^(5/3))))/(3*b) - (-1/3*Cos[c + d*x]/(a*x^3) + (d^2*Cos[c + d*x])/(6*
a*x) - (b*Cos[c]*CosIntegral[d*x])/a^2 + (b*Cos[c + ((-1)^(1/3)*a^(1/3)*d)
/b^(1/3)]*CosIntegral[((-1)^(1/3)*a^(1/3)*d)/b^(1/3) - d*x])/(3*a^2) + (b*
Cos[c - (a^(1/3)*d)/b^(1/3)]*CosIntegral[(a^(1/3)*d)/b^(1/3) + d*x])/(3*a^
2) + (b*Cos[c - ((-1)^(2/3)*a^(1/3)*d)/b^(1/3)]*CosIntegral[((-1)^(2/3)*a^
(1/3)*d)/b^(1/3) + d*x])/(3*a^2) + (d^3*CosIntegral[d*x]*Sin[c])/(6*a) + (
d*Sin[c + d*x])/(6*a*x^2) + (d^3*Cos[c]*SinIntegral[d*x])/(6*a) + (b*Sin[c
]*SinIntegral[d*x])/a^2 + (b*Sin[c + ((-1)^(1/3)*a^(1/3)*d)/b^(1/3)]*Si...
```

3.111. $\int \frac{x\sin(c+dx)}{(a+bx^3)^3}\,dx$

### 3.111.3.1 Defintions of rubi rules used

rule 2009
```
Int[u_, x_Symbol] :> Simp[IntSum[u, x], x] /; SumQ[u]
```

rule 3824
```
Int[(x_)^(m_.)*((a_) + (b_.)*(x_)^(n_))^(p_)*Sin[(c_.) + (d_.)*(x_)], x_Sym
bol] :> Simp[x^(m - n + 1)*(a + b*x^n)^(p + 1)*(Sin[c + d*x]/(b*n*(p + 1)))
, x] + (-Simp[(m - n + 1)/(b*n*(p + 1))   Int[x^(m - n)*(a + b*x^n)^(p + 1)
*Sin[c + d*x], x], x] - Simp[d/(b*n*(p + 1))   Int[x^(m - n + 1)*(a + b*x^n
)^(p + 1)*Cos[c + d*x], x], x]) /; FreeQ[{a, b, c, d, m}, x] && ILtQ[p, -1]
 && IGtQ[n, 0] && (GtQ[m - n + 1, 0] || GtQ[n, 2]) && RationalQ[m]
```

rule 3825
```
Int[Cos[(c_.) + (d_.)*(x_)]*(x_)^(m_.)*((a_) + (b_.)*(x_)^(n_))^(p_), x_Sym
bol] :> Simp[x^(m - n + 1)*(a + b*x^n)^(p + 1)*(Cos[c + d*x]/(b*n*(p + 1)))
, x] + (-Simp[(m - n + 1)/(b*n*(p + 1))   Int[x^(m - n)*(a + b*x^n)^(p + 1)
*Cos[c + d*x], x], x] + Simp[d/(b*n*(p + 1))   Int[x^(m - n + 1)*(a + b*x^n
)^(p + 1)*Sin[c + d*x], x], x]) /; FreeQ[{a, b, c, d, m}, x] && ILtQ[p, -1]
 && IGtQ[n, 0] && (GtQ[m - n + 1, 0] || GtQ[n, 2]) && RationalQ[m]
```

rule 3826
```
Int[(x_)^(m_.)*((a_) + (b_.)*(x_)^(n_))^(p_)*Sin[(c_.) + (d_.)*(x_)], x_Sym
bol] :> Int[ExpandIntegrand[Sin[c + d*x], x^m*(a + b*x^n)^p, x], x] /; Free
Q[{a, b, c, d, m}, x] && ILtQ[p, 0] && IGtQ[n, 0] && (EqQ[n, 2] || EqQ[p, -
1]) && IntegerQ[m]
```

rule 3827
```
Int[Cos[(c_.) + (d_.)*(x_)]*(x_)^(m_.)*((a_) + (b_.)*(x_)^(n_))^(p_), x_Sym
bol] :> Int[ExpandIntegrand[Cos[c + d*x], x^m*(a + b*x^n)^p, x], x] /; Free
Q[{a, b, c, d, m}, x] && ILtQ[p, 0] && IGtQ[n, 0] && (EqQ[n, 2] || EqQ[p, -
1]) && IntegerQ[m]
```

### 3.111.4 Maple [C] (verified)

Result contains higher order function than in optimal. Order 9 vs. order 4.

Time = 1.38 (sec) , antiderivative size = 610, normalized size of antiderivative = 0.53

| method | result |
|---|---|
| risch | $\frac{idc\left(\sum_{\_R1=\mathrm{RootOf}\left(-3i\_Z^2bc-id^3a+ibc^3+b\_Z^3-3c^2b\_Z\right)}\frac{\left(-2ic\_R1+\_R1^2-c^2+6ic-6\_R1+10\right)\mathrm{e}^{\_R1}\mathrm{Ei}_1\left(-idx-i\right.}{-2ic\_R1+\_R1^2-c^2}\right.}{108a^2b}$ |
| derivativedivides | Expression too large to display |
| default | Expression too large to display |

input
```
int(x*sin(d*x+c)/(b*x^3+a)^3,x,method=_RETURNVERBOSE)
```

output
```
1/108*I*d/a^2/b*c*sum((-2*I*c*_R1+6*I*c+_R1^2-c^2-6*_R1+10)/(-2*I*c*_R1+_R
1^2-c^2)*exp(_R1)*Ei(1,_R1-I*d*x-I*c),_R1=RootOf(-3*I*_Z^2*b*c-I*d^3*a+I*b
*c^3+b*_Z^3-3*c^2*b*_Z))+1/108*I*d/a^2/b^2*sum((-2*I*b*_R1*c^2+4*I*b*_R1^2
+2*I*b*c^2+_R1^2*b*c+a*d^3-c^3*b-4*I*_R1*b+2*b*c*_R1+6*c*b)/(2*I*c*_R1-_R1
^2+c^2)*exp(_R1)*Ei(1,_R1-I*d*x-I*c),_R1=RootOf(-3*I*_Z^2*b*c-I*d^3*a+I*b*
c^3+b*_Z^3-3*c^2*b*_Z))-1/108*I*d/a^2/b*c*sum((-2*I*c*_R1-6*I*c+_R1^2-c^2+
6*_R1+10)/(-2*I*c*_R1+_R1^2-c^2)*exp(-_R1)*Ei(1,I*d*x+I*c-_R1),_R1=RootOf(
-3*I*_Z^2*b*c-I*d^3*a+I*b*c^3+b*_Z^3-3*c^2*b*_Z))-1/108*I*d/a^2/b^2*sum((-
2*I*b*_R1*c^2-4*I*b*_R1^2-2*I*b*c^2+_R1^2*b*c+a*d^3-c^3*b-4*I*_R1*b-2*b*c*
_R1+6*c*b)/(2*I*c*_R1-_R1^2+c^2)*exp(-_R1)*Ei(1,I*d*x+I*c-_R1),_R1=RootOf(
-3*I*_Z^2*b*c-I*d^3*a+I*b*c^3+b*_Z^3-3*c^2*b*_Z))+1/18*d^4/a*(b*d^3*x^3+a*
d^3)/b/(b^2*d^6*x^6+2*a*b*d^6*x^3+a^2*d^6)*cos(d*x+c)-1/18*d*(-4*b*d^5*x^5
-7*a*d^5*x^2)/a^2/(b^2*d^6*x^6+2*a*b*d^6*x^3+a^2*d^6)*sin(d*x+c)
```

### 3.111.5 Fricas [C] (verification not implemented)

Result contains complex when optimal does not.

Time = 0.37 (sec) , antiderivative size = 1319, normalized size of antiderivative = 1.16

$$\int \frac{x\sin(c+dx)}{(a+bx^3)^3}\,dx = \text{Too large to display}$$

input
```
integrate(x*sin(d*x+c)/(b*x^3+a)^3,x, algorithm="fricas")
```

output
```
-1/216*((8*a*b^2*d^3*x^6 + 16*a^2*b*d^3*x^3 + 8*a^3*d^3 + 4*(I*b^3*x^6 + 2
*I*a*b^2*x^3 + I*a^2*b + sqrt(3)*(b^3*x^6 + 2*a*b^2*x^3 + a^2*b))*(I*a*d^3
/b)^(2/3) - (a*b^2*d^3*x^6 + 2*a^2*b*d^3*x^3 + a^3*d^3 + sqrt(3)*(I*a*b^2*
d^3*x^6 + 2*I*a^2*b*d^3*x^3 + I*a^3*d^3))*(I*a*d^3/b)^(1/3))*Ei(-I*d*x + 1
/2*(I*a*d^3/b)^(1/3)*(-I*sqrt(3) - 1))*e^(1/2*(I*a*d^3/b)^(1/3)*(I*sqrt(3)
 + 1) - I*c) + (8*a*b^2*d^3*x^6 + 16*a^2*b*d^3*x^3 + 8*a^3*d^3 + 4*(-I*b^3
*x^6 - 2*I*a*b^2*x^3 - I*a^2*b - sqrt(3)*(b^3*x^6 + 2*a*b^2*x^3 + a^2*b))*
(-I*a*d^3/b)^(2/3) - (a*b^2*d^3*x^6 + 2*a^2*b*d^3*x^3 + a^3*d^3 + sqrt(3)*
(I*a*b^2*d^3*x^6 + 2*I*a^2*b*d^3*x^3 + I*a^3*d^3))*(-I*a*d^3/b)^(1/3))*Ei(
I*d*x + 1/2*(-I*a*d^3/b)^(1/3)*(-I*sqrt(3) - 1))*e^(1/2*(-I*a*d^3/b)^(1/3)
*(I*sqrt(3) + 1) + I*c) + (8*a*b^2*d^3*x^6 + 16*a^2*b*d^3*x^3 + 8*a^3*d^3
+ 4*(I*b^3*x^6 + 2*I*a*b^2*x^3 + I*a^2*b - sqrt(3)*(b^3*x^6 + 2*a*b^2*x^3
+ a^2*b))*(I*a*d^3/b)^(2/3) - (a*b^2*d^3*x^6 + 2*a^2*b*d^3*x^3 + a^3*d^3 +
 sqrt(3)*(-I*a*b^2*d^3*x^6 - 2*I*a^2*b*d^3*x^3 - I*a^3*d^3))*(I*a*d^3/b)^(
1/3))*Ei(-I*d*x + 1/2*(I*a*d^3/b)^(1/3)*(I*sqrt(3) - 1))*e^(1/2*(I*a*d^3/b
)^(1/3)*(-I*sqrt(3) + 1) - I*c) + (8*a*b^2*d^3*x^6 + 16*a^2*b*d^3*x^3 + 8*
a^3*d^3 + 4*(-I*b^3*x^6 - 2*I*a*b^2*x^3 - I*a^2*b + sqrt(3)*(b^3*x^6 + 2*a
*b^2*x^3 + a^2*b))*(-I*a*d^3/b)^(2/3) - (a*b^2*d^3*x^6 + 2*a^2*b*d^3*x^3 +
 a^3*d^3 + sqrt(3)*(-I*a*b^2*d^3*x^6 - 2*I*a^2*b*d^3*x^3 - I*a^3*d^3))*(-I
*a*d^3/b)^(1/3))*Ei(I*d*x + 1/2*(-I*a*d^3/b)^(1/3)*(I*sqrt(3) - 1))*e^(...
```

### 3.111.6 Sympy [F(-1)]

Timed out.

$$\int \frac{x\sin(c+dx)}{(a+bx^3)^3}\,dx = \text{Timed out}$$

input
```
integrate(x*sin(d*x+c)/(b*x**3+a)**3,x)
```

output
```
Timed out
```

### 3.111.7 Maxima [F]

$$\int \frac{x\sin(c+dx)}{(a+bx^3)^3}\,dx = \int \frac{x\sin(dx+c)}{(bx^3+a)^3}\,dx$$

input
```
integrate(x*sin(d*x+c)/(b*x^3+a)^3,x, algorithm="maxima")
```

output
```
-1/2*((cos(c)^2 + sin(c)^2)*x*cos(d*x + c) + (x*cos(d*x + c)^2*cos(c) + x*
cos(c)*sin(d*x + c)^2)*cos(d*x + 2*c) + 2*(((b^3*cos(c)^2 + b^3*sin(c)^2)*
d*x^9 + 3*(a*b^2*cos(c)^2 + a*b^2*sin(c)^2)*d*x^6 + 3*(a^2*b*cos(c)^2 + a^
2*b*sin(c)^2)*d*x^3 + (a^3*cos(c)^2 + a^3*sin(c)^2)*d)*cos(d*x + c)^2 + ((
b^3*cos(c)^2 + b^3*sin(c)^2)*d*x^9 + 3*(a*b^2*cos(c)^2 + a*b^2*sin(c)^2)*d
*x^6 + 3*(a^2*b*cos(c)^2 + a^2*b*sin(c)^2)*d*x^3 + (a^3*cos(c)^2 + a^3*sin
(c)^2)*d)*sin(d*x + c)^2)*integrate(1/2*(8*b*x^3 - a)*cos(d*x + c)/(b^4*d*
x^12 + 4*a*b^3*d*x^9 + 6*a^2*b^2*d*x^6 + 4*a^3*b*d*x^3 + a^4*d), x) + 2*((
(b^3*cos(c)^2 + b^3*sin(c)^2)*d*x^9 + 3*(a*b^2*cos(c)^2 + a*b^2*sin(c)^2)*
d*x^6 + 3*(a^2*b*cos(c)^2 + a^2*b*sin(c)^2)*d*x^3 + (a^3*cos(c)^2 + a^3*si
n(c)^2)*d)*cos(d*x + c)^2 + ((b^3*cos(c)^2 + b^3*sin(c)^2)*d*x^9 + 3*(a*b^
2*cos(c)^2 + a*b^2*sin(c)^2)*d*x^6 + 3*(a^2*b*cos(c)^2 + a^2*b*sin(c)^2)*d
*x^3 + (a^3*cos(c)^2 + a^3*sin(c)^2)*d)*sin(d*x + c)^2)*integrate(1/2*(8*b
*x^3 - a)*cos(d*x + c)/((b^4*d*x^12 + 4*a*b^3*d*x^9 + 6*a^2*b^2*d*x^6 + 4*
a^3*b*d*x^3 + a^4*d)*cos(d*x + c)^2 + (b^4*d*x^12 + 4*a*b^3*d*x^9 + 6*a^2*
b^2*d*x^6 + 4*a^3*b*d*x^3 + a^4*d)*sin(d*x + c)^2), x) + (x*cos(d*x + c)^2
*sin(c) + x*sin(d*x + c)^2*sin(c))*sin(d*x + 2*c))/(((b^3*cos(c)^2 + b^3*s
in(c)^2)*d*x^9 + 3*(a*b^2*cos(c)^2 + a*b^2*sin(c)^2)*d*x^6 + 3*(a^2*b*cos(
c)^2 + a^2*b*sin(c)^2)*d*x^3 + (a^3*cos(c)^2 + a^3*sin(c)^2)*d)*cos(d*x +
c)^2 + ((b^3*cos(c)^2 + b^3*sin(c)^2)*d*x^9 + 3*(a*b^2*cos(c)^2 + a*b^2...
```

### 3.111.8 Giac [F]

$$\int \frac{x\sin(c+dx)}{(a+bx^3)^3}\,dx = \int \frac{x\sin(dx+c)}{(bx^3+a)^3}\,dx$$

input
```
integrate(x*sin(d*x+c)/(b*x^3+a)^3,x, algorithm="giac")
```

output
```
integrate(x*sin(d*x + c)/(b*x^3 + a)^3, x)
```

### 3.111.9 Mupad [F(-1)]

Timed out.

$$\int \frac{x\sin(c+dx)}{(a+bx^3)^3}\,dx=\int \frac{x\,\sin\left(c+d\,x\right)}{{\left(b\,x^3+a\right)}^3}\,dx$$

input
```
int((x*sin(c + d*x))/(a + b*x^3)^3,x)
```

output
```
int((x*sin(c + d*x))/(a + b*x^3)^3, x)
```

# 3.112 $\int \frac{\sin(c+dx)}{(a+bx^3)^3} dx$



## 3.112.1 Optimal result

Integrand size = 16, antiderivative size = 1161

$$\int \frac{\sin(c+dx)}{(a+bx^3)^3} dx = \text{Too large to display}$$

output
```
-5/27*(-1)^(1/3)*cos(c+(-1)^(1/3)*a^(1/3)*d/b^(1/3))*Si(-(-1)^(1/3)*a^(1/3
)*d/b^(1/3)+d*x)/a^(8/3)/b^(1/3)+1/18*d*cos(d*x+c)/a/b^2/x^4-1/18*d*cos(d*
x+c)/a^2/b/x+5/27*(-1)^(2/3)*cos(c-(-1)^(2/3)*a^(1/3)*d/b^(1/3))*Si((-1)^(
2/3)*a^(1/3)*d/b^(1/3)+d*x)/a^(8/3)/b^(1/3)-1/54*d^2*cos(c-(-1)^(2/3)*a^(1
/3)*d/b^(1/3))*Si((-1)^(2/3)*a^(1/3)*d/b^(1/3)+d*x)/a^2/b-1/18*d*cos(d*x+c
)/b^2/x^4/(b*x^3+a)-1/54*d^2*cos(c-a^(1/3)*d/b^(1/3))*Si(a^(1/3)*d/b^(1/3)
+d*x)/a^2/b-1/54*d^2*Ci(a^(1/3)*d/b^(1/3)+d*x)*sin(c-a^(1/3)*d/b^(1/3))/a^
2/b-1/9*d*Si(a^(1/3)*d/b^(1/3)+d*x)*sin(c-a^(1/3)*d/b^(1/3))/a^(7/3)/b^(2/
3)-5/27*(-1)^(1/3)*Ci((-1)^(1/3)*a^(1/3)*d/b^(1/3)-d*x)*sin(c+(-1)^(1/3)*a
^(1/3)*d/b^(1/3))/a^(8/3)/b^(1/3)-1/54*d^2*Ci((-1)^(1/3)*a^(1/3)*d/b^(1/3)
-d*x)*sin(c+(-1)^(1/3)*a^(1/3)*d/b^(1/3))/a^2/b-1/9*(-1)^(2/3)*d*Si(-(-1)^
(1/3)*a^(1/3)*d/b^(1/3)+d*x)*sin(c+(-1)^(1/3)*a^(1/3)*d/b^(1/3))/a^(7/3)/b
^(2/3)+1/9*(-1)^(2/3)*d*Ci((-1)^(1/3)*a^(1/3)*d/b^(1/3)-d*x)*cos(c+(-1)^(1
/3)*a^(1/3)*d/b^(1/3))/a^(7/3)/b^(2/3)-1/9*(-1)^(1/3)*d*Ci((-1)^(2/3)*a^(1
/3)*d/b^(1/3)+d*x)*cos(c-(-1)^(2/3)*a^(1/3)*d/b^(1/3))/a^(7/3)/b^(2/3)+1/9
*(-1)^(1/3)*d*Si((-1)^(2/3)*a^(1/3)*d/b^(1/3)+d*x)*sin(c-(-1)^(2/3)*a^(1/3
)*d/b^(1/3))/a^(7/3)/b^(2/3)+5/27*(-1)^(2/3)*Ci((-1)^(2/3)*a^(1/3)*d/b^(1/
3)+d*x)*sin(c-(-1)^(2/3)*a^(1/3)*d/b^(1/3))/a^(8/3)/b^(1/3)-1/54*d^2*Ci((-
1)^(2/3)*a^(1/3)*d/b^(1/3)+d*x)*sin(c-(-1)^(2/3)*a^(1/3)*d/b^(1/3))/a^2/b-
1/54*d^2*cos(c+(-1)^(1/3)*a^(1/3)*d/b^(1/3))*Si(-(-1)^(1/3)*a^(1/3)*d/b...
```

### 3.112.2 Mathematica [C] (verified)

Result contains higher order function than in optimal. Order 9 vs. order 4 in optimal.

Time = 0.32 (sec) , antiderivative size = 675, normalized size of antiderivative = 0.58

$$\int \frac{\sin(c+dx)}{(a+bx^3)^3}\,dx$$

$$= \frac{-\frac{i\,\mathrm{RootSum}\left[a+b\#1^3\&,\frac{-10\cos(c+d\#1)\,\mathrm{CosIntegral}(d(x-\#1))+10i\,\mathrm{CosIntegral}(d(x-\#1))\sin(c+d\#1)+10i\cos(c+d\#1)\mathrm{Si}(d(x-\#1))+10\sin}{}\right.}{}}{}$$

input
```
Integrate[Sin[c + d*x]/(a + b*x^3)^3,x]
```

output
```
(((-I)*RootSum[a + b*#1^3 & , (-10*Cos[c + d*#1]*CosIntegral[d*(x - #1)] +
 (10*I)*CosIntegral[d*(x - #1)]*Sin[c + d*#1] + (10*I)*Cos[c + d*#1]*SinIn
tegral[d*(x - #1)] + 10*Sin[c + d*#1]*SinIntegral[d*(x - #1)] - (6*I)*d*Co
s[c + d*#1]*CosIntegral[d*(x - #1)]*#1 - 6*d*CosIntegral[d*(x - #1)]*Sin[c
 + d*#1]*#1 - 6*d*Cos[c + d*#1]*SinIntegral[d*(x - #1)]*#1 + (6*I)*d*Sin[c
 + d*#1]*SinIntegral[d*(x - #1)]*#1 + d^2*Cos[c + d*#1]*CosIntegral[d*(x -
 #1)]*#1^2 - I*d^2*CosIntegral[d*(x - #1)]*Sin[c + d*#1]*#1^2 - I*d^2*Cos[
c + d*#1]*SinIntegral[d*(x - #1)]*#1^2 - d^2*Sin[c + d*#1]*SinIntegral[d*(
x - #1)]*#1^2)/#1^2 & ])/b + (I*RootSum[a + b*#1^3 & , (-10*Cos[c + d*#1]*
CosIntegral[d*(x - #1)] - (10*I)*CosIntegral[d*(x - #1)]*Sin[c + d*#1] - (
10*I)*Cos[c + d*#1]*SinIntegral[d*(x - #1)] + 10*Sin[c + d*#1]*SinIntegral
[d*(x - #1)] + (6*I)*d*Cos[c + d*#1]*CosIntegral[d*(x - #1)]*#1 - 6*d*CosI
ntegral[d*(x - #1)]*Sin[c + d*#1]*#1 - 6*d*Cos[c + d*#1]*SinIntegral[d*(x
- #1)]*#1 - (6*I)*d*Sin[c + d*#1]*SinIntegral[d*(x - #1)]*#1 + d^2*Cos[c +
 d*#1]*CosIntegral[d*(x - #1)]*#1^2 + I*d^2*CosIntegral[d*(x - #1)]*Sin[c
+ d*#1]*#1^2 + I*d^2*Cos[c + d*#1]*SinIntegral[d*(x - #1)]*#1^2 - d^2*Sin[
c + d*#1]*SinIntegral[d*(x - #1)]*#1^2)/#1^2 & ])/b - (6*x*Cos[d*x]*(d*x*(
a + b*x^3)*Cos[c] - (8*a + 5*b*x^3)*Sin[c]))/(a + b*x^3)^2 + (6*x*((8*a +
5*b*x^3)*Cos[c] + d*x*(a + b*x^3)*Sin[c])*Sin[d*x])/(a + b*x^3)^2)/(108*a^
2)
```

### 3.112.3 Rubi [A] (verified)

Time = 4.16 (sec) , antiderivative size = 2020, normalized size of antiderivative = 1.74, number of steps used = 7, number of rules used = 7, $\frac{\text{number of rules}}{\text{integrand size}}$ = 0.438, Rules used = {3812, 3824, 3825, 3826, 2009, 3827, 2009}

Below are the steps used by Rubi to obtain the solution. The rule number used for the transformation is given above next to the arrow. The rules definitions used are listed below.

$$\int \frac{\sin(c+dx)}{(a+bx^3)^3}dx$$

$$\Big\downarrow \text{3812}$$

$$-\frac{\int \frac{\sin(c+dx)}{x^3(bx^3+a)^2}dx}{3b}+\frac{d\int \frac{\cos(c+dx)}{x^2(bx^3+a)^2}dx}{6b}-\frac{\sin(c+dx)}{6bx^2(a+bx^3)^2}$$

$$\Big\downarrow \text{3824}$$

$$\frac{d\int \frac{\cos(c+dx)}{x^2(bx^3+a)^2}dx}{6b}-\frac{-\frac{5\int \frac{\sin(c+dx)}{x^6(bx^3+a)}dx}{3b}+\frac{d\int \frac{\cos(c+dx)}{x^5(bx^3+a)}dx}{3b}-\frac{\sin(c+dx)}{3bx^5(a+bx^3)}}{3b}-\frac{\sin(c+dx)}{6bx^2(a+bx^3)^2}$$

$$\Big\downarrow \text{3825}$$

$$-\frac{-\frac{5\int \frac{\sin(c+dx)}{x^6(bx^3+a)}dx}{3b}+\frac{d\int \frac{\cos(c+dx)}{x^5(bx^3+a)}dx}{3b}-\frac{\sin(c+dx)}{3bx^5(a+bx^3)}}{3b}+\frac{d\left(-\frac{4\int \frac{\cos(c+dx)}{x^5(bx^3+a)}dx}{3b}-\frac{d\int \frac{\sin(c+dx)}{x^4(bx^3+a)}dx}{3b}-\frac{\cos(c+dx)}{3bx^4(a+bx^3)}\right)}{6b}-\frac{\sin(c+dx)}{6bx^2(a+bx^3)^2}$$

$$\Big\downarrow \text{3826}$$

$$-\frac{-\frac{5\int \left(\frac{\sin(c+dx)b^2}{a^2(bx^3+a)}-\frac{\sin(c+dx)b}{a^2x^3}+\frac{\sin(c+dx)}{ax^6}\right)dx}{3b}+\frac{d\int \frac{\cos(c+dx)}{x^5(bx^3+a)}dx}{3b}-\frac{\sin(c+dx)}{3bx^5(a+bx^3)}}{3b}+\frac{d\left(-\frac{d\int \left(\frac{b^2\sin(c+dx)x^2}{a^2(bx^3+a)}-\frac{b\sin(c+dx)}{a^2x}+\frac{\sin(c+dx)}{ax^4}\right)dx}{3b}-\frac{4\int \frac{\cos(c+dx)}{x^5(bx^3+a)}dx}{3b}-\frac{\cos(c+dx)}{3bx^4(a+bx^3)}\right)}{6b}-\frac{\sin(c+dx)}{6bx^2(a+bx^3)^2}$$

$$\Big\downarrow \text{2009}$$

$$-\frac{\sin(c+dx)}{6bx^2\left(bx^3+a\right)^2}+$$

$$\frac{d\left(-\frac{\cos(c+dx)}{3bx^4(bx^3+a)}-\frac{d\left(-\frac{\cos(c)\,\text{CosIntegral}(dx)d^3}{6a}+\frac{\sin(c)\text{Si}(dx)d^3}{6a}+\frac{\sin(c+dx)d^2}{6ax}-\frac{\cos(c+dx)d}{6ax^2}-\frac{b\,\text{CosIntegral}(dx)\sin(c)}{a^2}+\frac{b\,\text{CosIntegral}\left(xd+\frac{\sqrt[3]{a}d}{\sqrt[3]{b}}\right)\text{si}}{3a^2}\right.}{}\right.}{-\frac{\sin(c+dx)}{3bx^5(bx^3+a)}-\frac{5\left(\frac{\cos(c)\,\text{CosIntegral}(dx)d^5}{120a}-\frac{\sin(c)\text{Si}(dx)d^5}{120a}-\frac{\sin(c+dx)d^4}{120ax}+\frac{\cos(c+dx)d^3}{120ax^2}+\frac{b\,\text{CosIntegral}(dx)\sin(c)d^2}{2a^2}+\frac{\sin(c+dx)d^2}{60ax^3}+\frac{b\cos(c)\text{Si}(dx)d^2}{2a^2}\right.}{}}$$

$\Big\downarrow$ 3827

$$-\frac{\sin(c+dx)}{6bx^2\left(bx^3+a\right)^2}+$$

$$\frac{d\left(-\frac{\cos(c+dx)}{3bx^4(bx^3+a)}-\frac{d\left(-\frac{\cos(c)\,\text{CosIntegral}(dx)d^3}{6a}+\frac{\sin(c)\text{Si}(dx)d^3}{6a}+\frac{\sin(c+dx)d^2}{6ax}-\frac{\cos(c+dx)d}{6ax^2}-\frac{b\,\text{CosIntegral}(dx)\sin(c)}{a^2}+\frac{b\,\text{CosIntegral}\left(xd+\frac{\sqrt[3]{a}d}{\sqrt[3]{b}}\right)\text{si}}{3a^2}\right.}{}\right.}{-\frac{\sin(c+dx)}{3bx^5(bx^3+a)}-\frac{5\left(\frac{\cos(c)\,\text{CosIntegral}(dx)d^5}{120a}-\frac{\sin(c)\text{Si}(dx)d^5}{120a}-\frac{\sin(c+dx)d^4}{120ax}+\frac{\cos(c+dx)d^3}{120ax^2}+\frac{b\,\text{CosIntegral}(dx)\sin(c)d^2}{2a^2}+\frac{\sin(c+dx)d^2}{60ax^3}+\frac{b\cos(c)\text{Si}(dx)d^2}{2a^2}\right.}{}}$$

$\Big\downarrow$ 2009

3.112. $\int \frac{\sin(c+dx)}{\left(a+bx^3\right)^3}\,dx$

$$-\frac{\sin(c+dx)}{6bx^2\left(bx^3+a\right)^2}+$$

$$\frac{d\left(-\frac{\cos(c+dx)}{3bx^4(bx^3+a)}-\frac{d\left(-\frac{\cos(c)\operatorname{CosIntegral}(dx)d^3}{6a}+\frac{\sin(c)\operatorname{Si}(dx)d^3}{6a}+\frac{\sin(c+dx)d^2}{6ax}-\frac{\cos(c+dx)d}{6ax^2}-\frac{b\operatorname{CosIntegral}(dx)\sin(c)}{a^2}+\frac{b\operatorname{CosIntegral}\left(xd+\frac{\sqrt[3]{a}d}{\sqrt[3]{b}}\right)\operatorname{si}\cdots}{3a^2}\cdots\right.}{\cdots}\right.}{\cdots}$$

$$\frac{-\frac{\sin(c+dx)}{3bx^5(bx^3+a)}-\frac{5\left(\frac{\cos(c)\operatorname{CosIntegral}(dx)d^5}{120a}-\frac{\sin(c)\operatorname{Si}(dx)d^5}{120a}-\frac{\sin(c+dx)d^4}{120ax}+\frac{\cos(c+dx)d^3}{120ax^2}+\frac{b\operatorname{CosIntegral}(dx)\sin(c)d^2}{2a^2}+\frac{\sin(c+dx)d^2}{60ax^3}+\frac{b\cos(c)\operatorname{Si}(dx)d^2}{2a^2}\cdots\right.}{\cdots}}{\cdots}$$

input
```
Int[Sin[c + d*x]/(a + b*x^3)^3,x]
```

output
```
-1/6*Sin[c + d*x]/(b*x^2*(a + b*x^3)^2) + (d*(-1/3*Cos[c + d*x]/(b*x^4*(a
+ b*x^3)) - (d*(-1/6*(d*Cos[c + d*x])/(a*x^2) - (d^3*Cos[c]*CosIntegral[d*
x])/(6*a) - (b*CosIntegral[d*x]*Sin[c])/a^2 + (b*CosIntegral[(a^(1/3)*d)/b
^(1/3) + d*x]*Sin[c - (a^(1/3)*d)/b^(1/3)])/(3*a^2) + (b*CosIntegral[((-1)
^(1/3)*a^(1/3)*d)/b^(1/3) - d*x]*Sin[c + ((-1)^(1/3)*a^(1/3)*d)/b^(1/3)])/
(3*a^2) + (b*CosIntegral[((-1)^(2/3)*a^(1/3)*d)/b^(1/3) + d*x]*Sin[c - ((-
1)^(2/3)*a^(1/3)*d)/b^(1/3)])/(3*a^2) - Sin[c + d*x]/(3*a*x^3) + (d^2*Sin[
c + d*x])/(6*a*x) - (b*Cos[c]*SinIntegral[d*x])/a^2 + (d^3*Sin[c]*SinInteg
ral[d*x])/(6*a) - (b*Cos[c + ((-1)^(1/3)*a^(1/3)*d)/b^(1/3)]*SinIntegral[(
(-1)^(1/3)*a^(1/3)*d)/b^(1/3) - d*x])/(3*a^2) + (b*Cos[c - (a^(1/3)*d)/b^(
1/3)]*SinIntegral[(a^(1/3)*d)/b^(1/3) + d*x])/(3*a^2) + (b*Cos[c - ((-1)^(
2/3)*a^(1/3)*d)/b^(1/3)]*SinIntegral[((-1)^(2/3)*a^(1/3)*d)/b^(1/3) + d*x]
)/(3*a^2)))/(3*b) - (4*(-1/4*Cos[c + d*x]/(a*x^4) + (d^2*Cos[c + d*x])/(24
*a*x^2) + (b*Cos[c + d*x])/(a^2*x) + (d^4*Cos[c]*CosIntegral[d*x])/(24*a)
- ((-1)^(2/3)*b^(4/3)*Cos[c + ((-1)^(1/3)*a^(1/3)*d)/b^(1/3)]*CosIntegral[
((-1)^(1/3)*a^(1/3)*d)/b^(1/3) - d*x])/(3*a^(7/3)) - (b^(4/3)*Cos[c - (a^(
1/3)*d)/b^(1/3)]*CosIntegral[(a^(1/3)*d)/b^(1/3) + d*x])/(3*a^(7/3)) + ((-
1)^(1/3)*b^(4/3)*Cos[c - ((-1)^(2/3)*a^(1/3)*d)/b^(1/3)]*CosIntegral[((-1)
^(2/3)*a^(1/3)*d)/b^(1/3) + d*x])/(3*a^(7/3)) + (b*d*CosIntegral[d*x]*Sin[
c])/a^2 + (d*Sin[c + d*x])/(12*a*x^3) - (d^3*Sin[c + d*x])/(24*a*x) + (...
```

## 3.112. $\int \frac{\sin(c+dx)}{(a+bx^3)^3}\,dx$

#### 3.112.3.1 Defintions of rubi rules used

rule 2009
```
Int[u_, x_Symbol] :> Simp[IntSum[u, x], x] /; SumQ[u]
```

rule 3812
```
Int[((a_) + (b_.)*(x_)^(n_))^(p_)*Sin[(c_.) + (d_.)*(x_)], x_Symbol] :> Sim
p[x^(-n + 1)*(a + b*x^n)^(p + 1)*(Sin[c + d*x]/(b*n*(p + 1))), x] + (-Simp[
(-n + 1)/(b*n*(p + 1))   Int[((a + b*x^n)^(p + 1)*Sin[c + d*x])/x^n, x], x]
 - Simp[d/(b*n*(p + 1))   Int[x^(-n + 1)*(a + b*x^n)^(p + 1)*Cos[c + d*x],
x], x]) /; FreeQ[{a, b, c, d}, x] && ILtQ[p, -1] && IGtQ[n, 2]
```

rule 3824
```
Int[(x_)^(m_.)*((a_) + (b_.)*(x_)^(n_))^(p_)*Sin[(c_.) + (d_.)*(x_)], x_Sym
bol] :> Simp[x^(m - n + 1)*(a + b*x^n)^(p + 1)*(Sin[c + d*x]/(b*n*(p + 1)))
, x] + (-Simp[(m - n + 1)/(b*n*(p + 1))   Int[x^(m - n)*(a + b*x^n)^(p + 1)
*Sin[c + d*x], x], x] - Simp[d/(b*n*(p + 1))   Int[x^(m - n + 1)*(a + b*x^n
)^(p + 1)*Cos[c + d*x], x], x]) /; FreeQ[{a, b, c, d, m}, x] && ILtQ[p, -1]
 && IGtQ[n, 0] && (GtQ[m - n + 1, 0] || GtQ[n, 2]) && RationalQ[m]
```

rule 3825
```
Int[Cos[(c_.) + (d_.)*(x_)]*(x_)^(m_.)*((a_) + (b_.)*(x_)^(n_))^(p_), x_Sym
bol] :> Simp[x^(m - n + 1)*(a + b*x^n)^(p + 1)*(Cos[c + d*x]/(b*n*(p + 1)))
, x] + (-Simp[(m - n + 1)/(b*n*(p + 1))   Int[x^(m - n)*(a + b*x^n)^(p + 1)
*Cos[c + d*x], x], x] + Simp[d/(b*n*(p + 1))   Int[x^(m - n + 1)*(a + b*x^n
)^(p + 1)*Sin[c + d*x], x], x]) /; FreeQ[{a, b, c, d, m}, x] && ILtQ[p, -1]
 && IGtQ[n, 0] && (GtQ[m - n + 1, 0] || GtQ[n, 2]) && RationalQ[m]
```

rule 3826
```
Int[(x_)^(m_.)*((a_) + (b_.)*(x_)^(n_))^(p_)*Sin[(c_.) + (d_.)*(x_)], x_Sym
bol] :> Int[ExpandIntegrand[Sin[c + d*x], x^m*(a + b*x^n)^p, x], x] /; Free
Q[{a, b, c, d, m}, x] && ILtQ[p, 0] && IGtQ[n, 0] && (EqQ[n, 2] || EqQ[p, -
1]) && IntegerQ[m]
```

rule 3827
```
Int[Cos[(c_.) + (d_.)*(x_)]*(x_)^(m_.)*((a_) + (b_.)*(x_)^(n_))^(p_), x_Sym
bol] :> Int[ExpandIntegrand[Cos[c + d*x], x^m*(a + b*x^n)^p, x], x] /; Free
Q[{a, b, c, d, m}, x] && ILtQ[p, 0] && IGtQ[n, 0] && (EqQ[n, 2] || EqQ[p, -
1]) && IntegerQ[m]
```

### 3.112.4 Maple [C] (verified)

Result contains higher order function than in optimal. Order 9 vs. order 4.

Time = 1.05 (sec) , antiderivative size = 340, normalized size of antiderivative = 0.29

| method | result |
|---|---|
| risch | $-\frac{i d^{2}\left(\sum_{\_R1=\mathrm{RootOf}\left(-3i\_Z^{2}bc-i d^{3}a+ib\,c^{3}+b\_Z^{3}-3c^{2}b\_Z\right)}\frac{\left(-2ic\_R1+\_R1^{2}-c^{2}+6ic-6\_R1+10\right)e^{\_R1}\,\mathrm{Ei}_{1}\left(-idx\right.}{-2ic\_R1+\_R1^{2}-c^{2}}\right.}{108a^{2}b}$ |
| derivativedivides | $d^{8}\left(-\frac{\sin(dx+c)\left(8ac\,d^{3}-8a\,d^{3}(dx+c)-5b\,c^{4}+20b\,c^{3}(dx+c)-30b\,c^{2}(dx+c)^{2}+20bc(dx+c)^{3}-5b(dx+c)^{4}\right)}{18a^{2}d^{6}\left(a\,d^{3}-c^{3}b+3b\,c^{2}(dx+c)-3bc(dx+c)^{2}+b(dx+c)^{3}\right)^{2}}-\frac{}{18a^{2}d^{6}(}\right.$ |
| default | $d^{8}\left(-\frac{\sin(dx+c)\left(8ac\,d^{3}-8a\,d^{3}(dx+c)-5b\,c^{4}+20b\,c^{3}(dx+c)-30b\,c^{2}(dx+c)^{2}+20bc(dx+c)^{3}-5b(dx+c)^{4}\right)}{18a^{2}d^{6}\left(a\,d^{3}-c^{3}b+3b\,c^{2}(dx+c)-3bc(dx+c)^{2}+b(dx+c)^{3}\right)^{2}}-\frac{}{18a^{2}d^{6}(}\right.$ |

input
```
int(sin(d*x+c)/(b*x^3+a)^3,x,method=_RETURNVERBOSE)
```

output
```
-1/108*I*d^2/a^2/b*sum((-2*I*c*_R1+6*I*c+_R1^2-c^2-6*_R1+10)/(-2*I*c*_R1+_
R1^2-c^2)*exp(_R1)*Ei(1,_R1-I*d*x-I*c),_R1=RootOf(-3*I*_Z^2*b*c-I*d^3*a+I*
b*c^3+b*_Z^3-3*c^2*b*_Z))+1/108*I*d^2/a^2/b*sum((-2*I*c*_R1-6*I*c+_R1^2-c^
2+6*_R1+10)/(-2*I*c*_R1+_R1^2-c^2)*exp(-_R1)*Ei(1,I*d*x+I*c-_R1),_R1=RootO
f(-3*I*_Z^2*b*c-I*d^3*a+I*b*c^3+b*_Z^3-3*c^2*b*_Z))+1/18*d^2*(-b*d^5*x^5-a
*d^5*x^2)/a^2/(b^2*d^6*x^6+2*a*b*d^6*x^3+a^2*d^6)*cos(d*x+c)+1/18*d^2*(5*b
*d^4*x^4+8*a*d^4*x)/a^2/(b^2*d^6*x^6+2*a*b*d^6*x^3+a^2*d^6)*sin(d*x+c)
```

### 3.112.5 Fricas [C] (verification not implemented)

Result contains complex when optimal does not.

Time = 0.33 (sec) , antiderivative size = 1223, normalized size of antiderivative = 1.05

$$\int \frac{\sin(c+dx)}{(a+bx^3)^3}\,dx = \text{Too large to display}$$

input
```
integrate(sin(d*x+c)/(b*x^3+a)^3,x, algorithm="fricas")
```

output
```
1/108*((-I*a*b^2*d^3*x^6 - 2*I*a^2*b*d^3*x^3 - I*a^3*d^3 + 3*(b^3*x^6 + 2*
a*b^2*x^3 + a^2*b - sqrt(3)*(I*b^3*x^6 + 2*I*a*b^2*x^3 + I*a^2*b))*(I*a*d^
3/b)^(2/3) + 5*(b^3*x^6 + 2*a*b^2*x^3 + a^2*b - sqrt(3)*(-I*b^3*x^6 - 2*I*
a*b^2*x^3 - I*a^2*b))*(I*a*d^3/b)^(1/3))*Ei(-I*d*x + 1/2*(I*a*d^3/b)^(1/3)
*(-I*sqrt(3) - 1))*e^(1/2*(I*a*d^3/b)^(1/3)*(I*sqrt(3) + 1) - I*c) + (I*a*
b^2*d^3*x^6 + 2*I*a^2*b*d^3*x^3 + I*a^3*d^3 + 3*(b^3*x^6 + 2*a*b^2*x^3 + a
^2*b - sqrt(3)*(I*b^3*x^6 + 2*I*a*b^2*x^3 + I*a^2*b))*(-I*a*d^3/b)^(2/3) +
 5*(b^3*x^6 + 2*a*b^2*x^3 + a^2*b - sqrt(3)*(-I*b^3*x^6 - 2*I*a*b^2*x^3 -
I*a^2*b))*(-I*a*d^3/b)^(1/3))*Ei(I*d*x + 1/2*(-I*a*d^3/b)^(1/3)*(-I*sqrt(3
) - 1))*e^(1/2*(-I*a*d^3/b)^(1/3)*(I*sqrt(3) + 1) + I*c) + (-I*a*b^2*d^3*x
^6 - 2*I*a^2*b*d^3*x^3 - I*a^3*d^3 + 3*(b^3*x^6 + 2*a*b^2*x^3 + a^2*b - sq
rt(3)*(-I*b^3*x^6 - 2*I*a*b^2*x^3 - I*a^2*b))*(I*a*d^3/b)^(2/3) + 5*(b^3*x
^6 + 2*a*b^2*x^3 + a^2*b - sqrt(3)*(I*b^3*x^6 + 2*I*a*b^2*x^3 + I*a^2*b))*
(I*a*d^3/b)^(1/3))*Ei(-I*d*x + 1/2*(I*a*d^3/b)^(1/3)*(I*sqrt(3) - 1))*e^(1
/2*(I*a*d^3/b)^(1/3)*(-I*sqrt(3) + 1) - I*c) + (I*a*b^2*d^3*x^6 + 2*I*a^2*
b*d^3*x^3 + I*a^3*d^3 + 3*(b^3*x^6 + 2*a*b^2*x^3 + a^2*b - sqrt(3)*(-I*b^3
*x^6 - 2*I*a*b^2*x^3 - I*a^2*b))*(-I*a*d^3/b)^(2/3) + 5*(b^3*x^6 + 2*a*b^2
*x^3 + a^2*b - sqrt(3)*(I*b^3*x^6 + 2*I*a*b^2*x^3 + I*a^2*b))*(-I*a*d^3/b)
^(1/3))*Ei(I*d*x + 1/2*(-I*a*d^3/b)^(1/3)*(I*sqrt(3) - 1))*e^(1/2*(-I*a*d^
3/b)^(1/3)*(-I*sqrt(3) + 1) + I*c) + (I*a*b^2*d^3*x^6 + 2*I*a^2*b*d^3*x...
```

### 3.112.6 Sympy [F(-1)]

Timed out.

$$\int \frac{\sin(c+dx)}{(a+bx^3)^3}\,dx = \text{Timed out}$$

input
```
integrate(sin(d*x+c)/(b*x**3+a)**3,x)
```

output
```
Timed out
```

### 3.112.7 Maxima [F]

$$\int \frac{\sin(c+dx)}{(a+bx^3)^3}\,dx = \int \frac{\sin(dx+c)}{(bx^3+a)^3}\,dx$$

input
```
integrate(sin(d*x+c)/(b*x^3+a)^3,x, algorithm="maxima")
```

output
```
integrate(sin(d*x + c)/(b*x^3 + a)^3, x)
```

### 3.112.8 Giac [F]

$$\int \frac{\sin(c+dx)}{(a+bx^3)^3}\,dx = \int \frac{\sin(dx+c)}{(bx^3+a)^3}\,dx$$

input
```
integrate(sin(d*x+c)/(b*x^3+a)^3,x, algorithm="giac")
```

output
```
integrate(sin(d*x + c)/(b*x^3 + a)^3, x)
```

### 3.112.9 Mupad [F(-1)]

Timed out.

$$\int \frac{\sin(c+dx)}{(a+bx^3)^3}\,dx = \int \frac{\sin(c+d\,x)}{(b\,x^3+a)^3}\,dx$$

input
```
int(sin(c + d*x)/(a + b*x^3)^3,x)
```

output
```
int(sin(c + d*x)/(a + b*x^3)^3, x)
```

# 3.113 $\int \frac{\sin(c+dx)}{x(a+bx^3)^3}\,dx$



## 3.113.1 Optimal result

Integrand size = 19, antiderivative size = 1163

$$\int \frac{\sin(c+dx)}{x(a+bx^3)^3}\,dx = \text{Too large to display}$$

output
```
-1/3*cos(c+(-1)^(1/3)*a^(1/3)*d/b^(1/3))*Si(-(-1)^(1/3)*a^(1/3)*d/b^(1/3)+
d*x)/a^3-1/3*cos(c-a^(1/3)*d/b^(1/3))*Si(a^(1/3)*d/b^(1/3)+d*x)/a^3-1/3*co
s(c-(-1)^(2/3)*a^(1/3)*d/b^(1/3))*Si((-1)^(2/3)*a^(1/3)*d/b^(1/3)+d*x)/a^3
-1/3*Ci(a^(1/3)*d/b^(1/3)+d*x)*sin(c-a^(1/3)*d/b^(1/3))/a^3-1/3*Ci((-1)^(1
/3)*a^(1/3)*d/b^(1/3)-d*x)*sin(c+(-1)^(1/3)*a^(1/3)*d/b^(1/3))/a^3-1/3*Ci(
(-1)^(2/3)*a^(1/3)*d/b^(1/3)+d*x)*sin(c-(-1)^(2/3)*a^(1/3)*d/b^(1/3))/a^3+
cos(c)*Si(d*x)/a^3+Ci(d*x)*sin(c)/a^3+1/54*(-1)^(2/3)*d^2*cos(c+(-1)^(1/3)
*a^(1/3)*d/b^(1/3))*Si(-(-1)^(1/3)*a^(1/3)*d/b^(1/3)+d*x)/a^(7/3)/b^(2/3)-
4/27*(-1)^(1/3)*d*Si(-(-1)^(1/3)*a^(1/3)*d/b^(1/3)+d*x)*sin(c+(-1)^(1/3)*a
^(1/3)*d/b^(1/3))/a^(8/3)/b^(1/3)+4/27*(-1)^(1/3)*d*Ci((-1)^(1/3)*a^(1/3)*
d/b^(1/3)-d*x)*cos(c+(-1)^(1/3)*a^(1/3)*d/b^(1/3))/a^(8/3)/b^(1/3)-4/27*(-
1)^(2/3)*d*Ci((-1)^(2/3)*a^(1/3)*d/b^(1/3)+d*x)*cos(c-(-1)^(2/3)*a^(1/3)*d
/b^(1/3))/a^(8/3)/b^(1/3)-1/54*(-1)^(1/3)*d^2*cos(c-(-1)^(2/3)*a^(1/3)*d/b
^(1/3))*Si((-1)^(2/3)*a^(1/3)*d/b^(1/3)+d*x)/a^(7/3)/b^(2/3)+1/54*(-1)^(2/
3)*d^2*Ci((-1)^(1/3)*a^(1/3)*d/b^(1/3)-d*x)*sin(c+(-1)^(1/3)*a^(1/3)*d/b^(
1/3))/a^(7/3)/b^(2/3)-1/54*(-1)^(1/3)*d^2*Ci((-1)^(2/3)*a^(1/3)*d/b^(1/3)+
d*x)*sin(c-(-1)^(2/3)*a^(1/3)*d/b^(1/3))/a^(7/3)/b^(2/3)+4/27*(-1)^(2/3)*d
*Si((-1)^(2/3)*a^(1/3)*d/b^(1/3)+d*x)*sin(c-(-1)^(2/3)*a^(1/3)*d/b^(1/3))/
a^(8/3)/b^(1/3)-4/27*d*Ci(a^(1/3)*d/b^(1/3)+d*x)*cos(c-a^(1/3)*d/b^(1/3))/
a^(8/3)/b^(1/3)+1/18*d*cos(d*x+c)/a/b^2/x^5-1/18*d*cos(d*x+c)/a^2/b/x^2...
```

### 3.113.2 Mathematica [C] (verified)

Result contains higher order function than in optimal. Order 9 vs. order 4 in optimal.

Time = 0.55 (sec) , antiderivative size = 2109, normalized size of antiderivative = 1.81

$$\int \frac{\sin(c+dx)}{x\,(a+bx^3)^3}\,dx = \text{Result too large to show}$$

input
```
Integrate[Sin[c + d*x]/(x*(a + b*x^3)^3),x]
```

output
```
(-6*a^2*b*d*x*Cos[c + d*x] - 6*a*b^2*d*x^4*Cos[c + d*x] - (18*I)*b*(a + b*
x^3)^2*RootSum[a + b*#1^3 & , Cos[c + d*#1]*CosIntegral[d*(x - #1)] - I*Co
sIntegral[d*(x - #1)]*Sin[c + d*#1] - I*Cos[c + d*#1]*SinIntegral[d*(x - #
1)] - Sin[c + d*#1]*SinIntegral[d*(x - #1)] & ] + (18*I)*b*(a + b*x^3)^2*R
ootSum[a + b*#1^3 & , Cos[c + d*#1]*CosIntegral[d*(x - #1)] + I*CosIntegra
l[d*(x - #1)]*Sin[c + d*#1] + I*Cos[c + d*#1]*SinIntegral[d*(x - #1)] - Si
n[c + d*#1]*SinIntegral[d*(x - #1)] & ] - 6*a^3*d*RootSum[a + b*#1^3 & , (
Cos[c + d*#1]*CosIntegral[d*(x - #1)] - I*CosIntegral[d*(x - #1)]*Sin[c +
d*#1] - I*Cos[c + d*#1]*SinIntegral[d*(x - #1)] - Sin[c + d*#1]*SinIntegra
l[d*(x - #1)])/#1^2 & ] - 12*a^2*b*d*x^3*RootSum[a + b*#1^3 & , (Cos[c + d
*#1]*CosIntegral[d*(x - #1)] - I*CosIntegral[d*(x - #1)]*Sin[c + d*#1] - I
*Cos[c + d*#1]*SinIntegral[d*(x - #1)] - Sin[c + d*#1]*SinIntegral[d*(x -
#1)])/#1^2 & ] - 6*a*b^2*d*x^6*RootSum[a + b*#1^3 & , (Cos[c + d*#1]*CosIn
tegral[d*(x - #1)] - I*CosIntegral[d*(x - #1)]*Sin[c + d*#1] - I*Cos[c + d
*#1]*SinIntegral[d*(x - #1)] - Sin[c + d*#1]*SinIntegral[d*(x - #1)])/#1^2
 & ] - 6*a^3*d*RootSum[a + b*#1^3 & , (Cos[c + d*#1]*CosIntegral[d*(x - #1
)] + I*CosIntegral[d*(x - #1)]*Sin[c + d*#1] + I*Cos[c + d*#1]*SinIntegral
[d*(x - #1)] - Sin[c + d*#1]*SinIntegral[d*(x - #1)])/#1^2 & ] - 12*a^2*b*
d*x^3*RootSum[a + b*#1^3 & , (Cos[c + d*#1]*CosIntegral[d*(x - #1)] + I*Co
sIntegral[d*(x - #1)]*Sin[c + d*#1] + I*Cos[c + d*#1]*SinIntegral[d*(x ...
```

### 3.113.3 Rubi [A] (verified)

Time = 4.59 (sec) , antiderivative size = 2229, normalized size of antiderivative = 1.92, number of steps used = 7, number of rules used = 7, $\frac{\text{number of rules}}{\text{integrand size}} = 0.368$, Rules used = {3824, 3824, 3825, 3826, 2009, 3827, 2009}

Below are the steps used by Rubi to obtain the solution. The rule number used for the transformation is given above next to the arrow. The rules definitions used are listed below.

$$\int \frac{\sin(c+dx)}{x\left(a+bx^3\right)^3}\,dx$$

$$\Big\downarrow \; 3824$$

$$\frac{d\int \frac{\cos(c+dx)}{x^3\left(bx^3+a\right)^2}dx}{6b}-\frac{\int \frac{\sin(c+dx)}{x^4\left(bx^3+a\right)^2}dx}{2b}-\frac{\sin(c+dx)}{6bx^3\left(a+bx^3\right)^2}$$

$$\Big\downarrow \; 3824$$

$$\frac{d\int \frac{\cos(c+dx)}{x^3\left(bx^3+a\right)^2}dx}{6b}-\frac{-\frac{2\int \frac{\sin(c+dx)}{x^7\left(bx^3+a\right)}dx}{b}+\frac{d\int \frac{\cos(c+dx)}{x^6\left(bx^3+a\right)}dx}{3b}-\frac{\sin(c+dx)}{3bx^6\left(a+bx^3\right)}}{2b}-\frac{\sin(c+dx)}{6bx^3\left(a+bx^3\right)^2}$$

$$\Big\downarrow \; 3825$$

$$-\frac{-\frac{2\int \frac{\sin(c+dx)}{x^7\left(bx^3+a\right)}dx}{b}+\frac{d\int \frac{\cos(c+dx)}{x^6\left(bx^3+a\right)}dx}{3b}-\frac{\sin(c+dx)}{3bx^6\left(a+bx^3\right)}}{2b}+\frac{d\left(-\frac{5\int \frac{\cos(c+dx)}{x^6\left(bx^3+a\right)}dx}{3b}-\frac{d\int \frac{\sin(c+dx)}{x^5\left(bx^3+a\right)}dx}{3b}-\frac{\cos(c+dx)}{3bx^5\left(a+bx^3\right)}\right)}{6b}-\frac{\sin(c+dx)}{6bx^3\left(a+bx^3\right)^2}$$

$$\Big\downarrow \; 3826$$

$$\frac{d\left(-\frac{d\int \left(\frac{x\sin(c+dx)b^2}{a^2\left(bx^3+a\right)}-\frac{\sin(c+dx)b}{a^2x^2}+\frac{\sin(c+dx)}{ax^5}\right)dx}{3b}-\frac{5\int \frac{\cos(c+dx)}{x^6\left(bx^3+a\right)}dx}{3b}-\frac{\cos(c+dx)}{3bx^5\left(a+bx^3\right)}\right)}{6b}-\frac{-\frac{2\int \left(-\frac{x^2\sin(c+dx)b^3}{a^3\left(bx^3+a\right)}+\frac{\sin(c+dx)b^2}{a^3x}-\frac{\sin(c+dx)b}{a^2x^4}+\frac{\sin(c+dx)}{ax^7}\right)dx}{b}+\frac{d\int \frac{\cos(c+dx)}{x^6\left(bx^3+a\right)}dx}{3b}-\frac{\sin(c+dx)}{3bx^6\left(a+bx^3\right)}}{2b}-\frac{\sin(c+dx)}{6bx^3\left(a+bx^3\right)^2}$$

$$\Big\downarrow \; 2009$$

3.113. $\int \frac{\sin(c+dx)}{x\left(a+bx^3\right)^3}\,dx$

$$-\frac{\sin(c+dx)}{6bx^3\left(bx^3+a\right)^2}+$$

$$\frac{d\left(-\frac{\cos(c+dx)}{3bx^5(bx^3+a)}-\frac{d\left(\frac{\text{CosIntegral}(dx)\sin(c)d^4}{24a}+\frac{\cos(c)\text{Si}(dx)d^4}{24a}+\frac{\cos(c+dx)d^3}{24ax}+\frac{\sin(c+dx)d^2}{24ax^2}-\frac{\cos(c+dx)d}{12ax^3}-\frac{b\cos(c)\,\text{CosIntegral}(dx)d}{a^2}+\frac{b\sin(c)\text{Si}(dx)d}{a^2}\cdots\right.}{\cdots}\right.}{-\frac{\sin(c+dx)}{3bx^6(bx^3+a)}-\frac{2\left(-\frac{\text{CosIntegral}(dx)\sin(c)d^6}{720a}-\frac{\cos(c)\text{Si}(dx)d^6}{720a}-\frac{\cos(c+dx)d^5}{720ax}-\frac{\sin(c+dx)d^4}{720ax^2}+\frac{\cos(c+dx)d^3}{360ax^3}+\frac{b\cos(c)\,\text{CosIntegral}(dx)d^3}{6a^2}-\frac{b\sin(c)\text{Si}(dx)d}{6a^2}\cdots\right.}{\cdots}}$$

$\downarrow$ 3827

$$-\frac{\sin(c+dx)}{6bx^3\left(bx^3+a\right)^2}+$$

$$\frac{d\left(-\frac{\cos(c+dx)}{3bx^5(bx^3+a)}-\frac{d\left(\frac{\text{CosIntegral}(dx)\sin(c)d^4}{24a}+\frac{\cos(c)\text{Si}(dx)d^4}{24a}+\frac{\cos(c+dx)d^3}{24ax}+\frac{\sin(c+dx)d^2}{24ax^2}-\frac{\cos(c+dx)d}{12ax^3}-\frac{b\cos(c)\,\text{CosIntegral}(dx)d}{a^2}+\frac{b\sin(c)\text{Si}(dx)d}{a^2}\cdots\right.}{\cdots}\right.}{-\frac{\sin(c+dx)}{3bx^6(bx^3+a)}-\frac{2\left(-\frac{\text{CosIntegral}(dx)\sin(c)d^6}{720a}-\frac{\cos(c)\text{Si}(dx)d^6}{720a}-\frac{\cos(c+dx)d^5}{720ax}-\frac{\sin(c+dx)d^4}{720ax^2}+\frac{\cos(c+dx)d^3}{360ax^3}+\frac{b\cos(c)\,\text{CosIntegral}(dx)d^3}{6a^2}-\frac{b\sin(c)\text{Si}(dx)d}{6a^2}\cdots\right.}{\cdots}}$$

$\downarrow$ 2009

---

3.113. $\int \frac{\sin(c+dx)}{x(a+bx^3)^3}\,dx$

$$-\frac{\sin(c+dx)}{6bx^3\left(bx^3+a\right)^2}+$$

$$d\left(-\frac{\cos(c+dx)}{3bx^5(bx^3+a)}-\frac{d\left(\frac{\text{CosIntegral}(dx)\sin(c)d^4}{24a}+\frac{\cos(c)\text{Si}(dx)d^4}{24a}+\frac{\cos(c+dx)d^3}{24ax}+\frac{\sin(c+dx)d^2}{24ax^2}-\frac{\cos(c+dx)d}{12ax^3}-\frac{b\cos(c)\text{ CosIntegral}(dx)d}{a^2}+\frac{b\sin(c)\text{Si}(dx)d}{a^2}\right.}{}\right.$$

$$-\frac{\sin(c+dx)}{3bx^6(bx^3+a)}-\frac{2\left(-\frac{\text{CosIntegral}(dx)\sin(c)d^6}{720a}-\frac{\cos(c)\text{Si}(dx)d^6}{720a}-\frac{\cos(c+dx)d^5}{720ax}-\frac{\sin(c+dx)d^4}{720ax^2}+\frac{\cos(c+dx)d^3}{360ax^3}+\frac{b\cos(c)\text{ CosIntegral}(dx)d^3}{6a^2}-\frac{b\sin(c)\text{Si}(dx)d}{6a^2}\right.}{}$$

input
```
Int[Sin[c + d*x]/(x*(a + b*x^3)^3),x]
```

output
```
-1/6*Sin[c + d*x]/(b*x^3*(a + b*x^3)^2) + (d*(-1/3*Cos[c + d*x]/(b*x^5*(a
+ b*x^3)) - (d*(-1/12*(d*Cos[c + d*x])/(a*x^3) + (d^3*Cos[c + d*x])/(24*a*
x) - (b*d*Cos[c]*CosIntegral[d*x])/a^2 + (d^4*CosIntegral[d*x]*Sin[c])/(24
*a) - (b^(4/3)*CosIntegral[(a^(1/3)*d)/b^(1/3) + d*x]*Sin[c - (a^(1/3)*d)/
b^(1/3)])/(3*a^(7/3)) - ((-1)^(2/3)*b^(4/3)*CosIntegral[((-1)^(1/3)*a^(1/3
)*d)/b^(1/3) - d*x]*Sin[c + ((-1)^(1/3)*a^(1/3)*d)/b^(1/3)])/(3*a^(7/3)) +
 ((-1)^(1/3)*b^(4/3)*CosIntegral[((-1)^(2/3)*a^(1/3)*d)/b^(1/3) + d*x]*Sin
[c - ((-1)^(2/3)*a^(1/3)*d)/b^(1/3)])/(3*a^(7/3)) - Sin[c + d*x]/(4*a*x^4)
 + (d^2*Sin[c + d*x])/(24*a*x^2) + (b*Sin[c + d*x])/(a^2*x) + (d^4*Cos[c]*
SinIntegral[d*x])/(24*a) + (b*d*Sin[c]*SinIntegral[d*x])/a^2 + ((-1)^(2/3)
*b^(4/3)*Cos[c + ((-1)^(1/3)*a^(1/3)*d)/b^(1/3)]*SinIntegral[((-1)^(1/3)*a
^(1/3)*d)/b^(1/3) - d*x])/(3*a^(7/3)) - (b^(4/3)*Cos[c - (a^(1/3)*d)/b^(1/
3)]*SinIntegral[(a^(1/3)*d)/b^(1/3) + d*x])/(3*a^(7/3)) + ((-1)^(1/3)*b^(4
/3)*Cos[c - ((-1)^(2/3)*a^(1/3)*d)/b^(1/3)]*SinIntegral[((-1)^(2/3)*a^(1/3
)*d)/b^(1/3) + d*x])/(3*a^(7/3))))/(3*b) - (5*(-1/5*Cos[c + d*x]/(a*x^5) +
 (d^2*Cos[c + d*x])/(60*a*x^3) + (b*Cos[c + d*x])/(2*a^2*x^2) - (d^4*Cos[c
 + d*x])/(120*a*x) + (b*d^2*Cos[c]*CosIntegral[d*x])/(2*a^2) - ((-1)^(1/3)
*b^(5/3)*Cos[c + ((-1)^(1/3)*a^(1/3)*d)/b^(1/3)]*CosIntegral[((-1)^(1/3)*a
^(1/3)*d)/b^(1/3) - d*x])/(3*a^(8/3)) + (b^(5/3)*Cos[c - (a^(1/3)*d)/b^(1/
3)]*CosIntegral[(a^(1/3)*d)/b^(1/3) + d*x])/(3*a^(8/3)) + ((-1)^(2/3)*b...
```

## 3.113. $\int \frac{\sin(c+dx)}{x(a+bx^3)^3}\,dx$

### 3.113.3.1 Defintions of rubi rules used

rule 2009
```
Int[u_, x_Symbol] :> Simp[IntSum[u, x], x] /; SumQ[u]
```

rule 3824
```
Int[(x_)^(m_.)*((a_) + (b_.)*(x_)^(n_))^(p_)*Sin[(c_.) + (d_.)*(x_)], x_Sym
bol] :> Simp[x^(m - n + 1)*(a + b*x^n)^(p + 1)*(Sin[c + d*x]/(b*n*(p + 1)))
, x] + (-Simp[(m - n + 1)/(b*n*(p + 1))   Int[x^(m - n)*(a + b*x^n)^(p + 1)
*Sin[c + d*x], x], x] - Simp[d/(b*n*(p + 1))   Int[x^(m - n + 1)*(a + b*x^n
)^(p + 1)*Cos[c + d*x], x], x]) /; FreeQ[{a, b, c, d, m}, x] && ILtQ[p, -1]
 && IGtQ[n, 0] && (GtQ[m - n + 1, 0] || GtQ[n, 2]) && RationalQ[m]
```

rule 3825
```
Int[Cos[(c_.) + (d_.)*(x_)]*(x_)^(m_.)*((a_) + (b_.)*(x_)^(n_))^(p_), x_Sym
bol] :> Simp[x^(m - n + 1)*(a + b*x^n)^(p + 1)*(Cos[c + d*x]/(b*n*(p + 1)))
, x] + (-Simp[(m - n + 1)/(b*n*(p + 1))   Int[x^(m - n)*(a + b*x^n)^(p + 1)
*Cos[c + d*x], x], x] + Simp[d/(b*n*(p + 1))   Int[x^(m - n + 1)*(a + b*x^n
)^(p + 1)*Sin[c + d*x], x], x]) /; FreeQ[{a, b, c, d, m}, x] && ILtQ[p, -1]
 && IGtQ[n, 0] && (GtQ[m - n + 1, 0] || GtQ[n, 2]) && RationalQ[m]
```

rule 3826
```
Int[(x_)^(m_.)*((a_) + (b_.)*(x_)^(n_))^(p_)*Sin[(c_.) + (d_.)*(x_)], x_Sym
bol] :> Int[ExpandIntegrand[Sin[c + d*x], x^m*(a + b*x^n)^p, x], x] /; Free
Q[{a, b, c, d, m}, x] && ILtQ[p, 0] && IGtQ[n, 0] && (EqQ[n, 2] || EqQ[p, -
1]) && IntegerQ[m]
```

rule 3827
```
Int[Cos[(c_.) + (d_.)*(x_)]*(x_)^(m_.)*((a_) + (b_.)*(x_)^(n_))^(p_), x_Sym
bol] :> Int[ExpandIntegrand[Cos[c + d*x], x^m*(a + b*x^n)^p, x], x] /; Free
Q[{a, b, c, d, m}, x] && ILtQ[p, 0] && IGtQ[n, 0] && (EqQ[n, 2] || EqQ[p, -
1]) && IntegerQ[m]
```

## 3.113. $\int \frac{\sin(c+dx)}{x(a+bx^3)^3} \, dx$

### 3.113.4 Maple [C] (verified)

Result contains higher order function than in optimal. Order 9 vs. order 4.

Time = 1.09 (sec) , antiderivative size = 363, normalized size of antiderivative = 0.31

| method | result |
|---|---|
| derivativedivides | $\frac{\sin(dx+c)d^3\left(3a\,d^3-2c^3b+6b\,c^2(dx+c)-6bc(dx+c)^2+2b(dx+c)^3\right)}{6a^2\left(a\,d^3-c^3b+3b\,c^2(dx+c)-3bc(dx+c)^2+b(dx+c)^3\right)^2}-\frac{\cos(dx+c)d^4x}{18a^2\left(a\,d^3-c^3b+3b\,c^2(dx+c)-3bc(dx+c)^2+b(dx\right.}$ |
| default | $\frac{\sin(dx+c)d^3\left(3a\,d^3-2c^3b+6b\,c^2(dx+c)-6bc(dx+c)^2+2b(dx+c)^3\right)}{6a^2\left(a\,d^3-c^3b+3b\,c^2(dx+c)-3bc(dx+c)^2+b(dx+c)^3\right)^2}-\frac{\cos(dx+c)d^4x}{18a^2\left(a\,d^3-c^3b+3b\,c^2(dx+c)-3bc(dx+c)^2+b(dx\right.}$ |
| risch | $-\frac{i\left(\sum_{\_R1=\mathrm{RootOf}\left(-3i\_Z^2bc-id^3a+ib\,c^3+b\_Z^3-3c^2b\_Z\right)}\frac{\left(i\_R1a\,d^3+ac\,d^3-8id^3a-36i\_R1bc+18b\_R1^2-18c^2b\right)\mathrm{e}^{-}}{-2ic\_R1+\_R1^2-c^2}\right.}{108b\,a^3}$ |

input
```
int(sin(d*x+c)/x/(b*x^3+a)^3,x,method=_RETURNVERBOSE)
```

output
```
1/6*sin(d*x+c)*d^3*(3*a*d^3-2*c^3*b+6*b*c^2*(d*x+c)-6*b*c*(d*x+c)^2+2*b*(d
*x+c)^3)/a^2/(a*d^3-c^3*b+3*b*c^2*(d*x+c)-3*b*c*(d*x+c)^2+b*(d*x+c)^3)^2-1
/18*cos(d*x+c)*d^4*x/a^2/(a*d^3-c^3*b+3*b*c^2*(d*x+c)-3*b*c*(d*x+c)^2+b*(d
*x+c)^3)+1/a^3*(Si(d*x)*cos(c)+Ci(d*x)*sin(c))+1/54/b/a^3*sum((a*d^3+18*_R
1*b-18*b*c)/(-_R1+c)*(-Si(-d*x+_R1-c)*cos(_R1)+Ci(d*x-_R1+c)*sin(_R1)),_R1
=RootOf(_Z^3*b-3*_Z^2*b*c+3*_Z*b*c^2+a*d^3-b*c^3))-4/27*d^3/a^2/b*sum(1/(_
RR1^2-2*_RR1*c+c^2)*(Si(-d*x+_RR1-c)*sin(_RR1)+Ci(d*x-_RR1+c)*cos(_RR1)),_
RR1=RootOf(_Z^3*b-3*_Z^2*b*c+3*_Z*b*c^2+a*d^3-b*c^3))
```

### 3.113.5 Fricas [C] (verification not implemented)

Result contains complex when optimal does not.

Time = 0.35 (sec) , antiderivative size = 1113, normalized size of antiderivative = 0.96

$$\int \frac{\sin(c+dx)}{x\,(a+bx^3)^3}\,dx=\text{Too large to display}$$

input
```
integrate(sin(d*x+c)/x/(b*x^3+a)^3,x, algorithm="fricas")
```

output
```
1/216*((-36*I*b^2*x^6 - 72*I*a*b*x^3 - 36*I*a^2 + (I*b^2*x^6 + 2*I*a*b*x^3
 + I*a^2 + sqrt(3)*(b^2*x^6 + 2*a*b*x^3 + a^2))*(I*a*d^3/b)^(2/3) - 8*(-I*
b^2*x^6 - 2*I*a*b*x^3 - I*a^2 + sqrt(3)*(b^2*x^6 + 2*a*b*x^3 + a^2))*(I*a*
d^3/b)^(1/3))*Ei(-I*d*x + 1/2*(I*a*d^3/b)^(1/3)*(-I*sqrt(3) - 1))*e^(1/2*(
I*a*d^3/b)^(1/3)*(I*sqrt(3) + 1) - I*c) + (36*I*b^2*x^6 + 72*I*a*b*x^3 + 3
6*I*a^2 + (-I*b^2*x^6 - 2*I*a*b*x^3 - I*a^2 - sqrt(3)*(b^2*x^6 + 2*a*b*x^3
 + a^2))*(-I*a*d^3/b)^(2/3) - 8*(I*b^2*x^6 + 2*I*a*b*x^3 + I*a^2 - sqrt(3)
*(b^2*x^6 + 2*a*b*x^3 + a^2))*(-I*a*d^3/b)^(1/3))*Ei(I*d*x + 1/2*(-I*a*d^3
/b)^(1/3)*(-I*sqrt(3) - 1))*e^(1/2*(-I*a*d^3/b)^(1/3)*(I*sqrt(3) + 1) + I*
c) + (-36*I*b^2*x^6 - 72*I*a*b*x^3 - 36*I*a^2 + (I*b^2*x^6 + 2*I*a*b*x^3 +
 I*a^2 - sqrt(3)*(b^2*x^6 + 2*a*b*x^3 + a^2))*(I*a*d^3/b)^(2/3) - 8*(-I*b^
2*x^6 - 2*I*a*b*x^3 - I*a^2 - sqrt(3)*(b^2*x^6 + 2*a*b*x^3 + a^2))*(I*a*d^
3/b)^(1/3))*Ei(-I*d*x + 1/2*(I*a*d^3/b)^(1/3)*(I*sqrt(3) - 1))*e^(1/2*(I*a
*d^3/b)^(1/3)*(-I*sqrt(3) + 1) - I*c) + (36*I*b^2*x^6 + 72*I*a*b*x^3 + 36*
I*a^2 + (-I*b^2*x^6 - 2*I*a*b*x^3 - I*a^2 + sqrt(3)*(b^2*x^6 + 2*a*b*x^3 +
 a^2))*(-I*a*d^3/b)^(2/3) - 8*(I*b^2*x^6 + 2*I*a*b*x^3 + I*a^2 + sqrt(3)*(
b^2*x^6 + 2*a*b*x^3 + a^2))*(-I*a*d^3/b)^(1/3))*Ei(I*d*x + 1/2*(-I*a*d^3/b
)^(1/3)*(I*sqrt(3) - 1))*e^(1/2*(-I*a*d^3/b)^(1/3)*(-I*sqrt(3) + 1) + I*c)
 - 2*(-18*I*b^2*x^6 - 36*I*a*b*x^3 - 18*I*a^2 + (-I*b^2*x^6 - 2*I*a*b*x^3
- I*a^2)*(-I*a*d^3/b)^(2/3) + 8*(-I*b^2*x^6 - 2*I*a*b*x^3 - I*a^2)*(-I*...
```

### 3.113.6 Sympy [F(-1)]

Timed out.

$$\int \frac{\sin(c+dx)}{x\left(a+bx^3\right)^3}\,dx=\text{Timed out}$$

input
```
integrate(sin(d*x+c)/x/(b*x**3+a)**3,x)
```

output
```
Timed out
```

## 3.113.7 Maxima [F]

$$\int \frac{\sin(c+dx)}{x(a+bx^3)^3}\,dx = \int \frac{\sin(dx+c)}{(bx^3+a)^3 x}\,dx$$

input
```
integrate(sin(d*x+c)/x/(b*x^3+a)^3,x, algorithm="maxima")
```

output
```
integrate(sin(d*x + c)/((b*x^3 + a)^3*x), x)
```

## 3.113.8 Giac [F]

$$\int \frac{\sin(c+dx)}{x(a+bx^3)^3}\,dx = \int \frac{\sin(dx+c)}{(bx^3+a)^3 x}\,dx$$

input
```
integrate(sin(d*x+c)/x/(b*x^3+a)^3,x, algorithm="giac")
```

output
```
integrate(sin(d*x + c)/((b*x^3 + a)^3*x), x)
```

## 3.113.9 Mupad [F(-1)]

Timed out.

$$\int \frac{\sin(c+dx)}{x(a+bx^3)^3}\,dx = \int \frac{\sin(c+d\,x)}{x\,(b\,x^3+a)^3}\,dx$$

input
```
int(sin(c + d*x)/(x*(a + b*x^3)^3),x)
```

output
```
int(sin(c + d*x)/(x*(a + b*x^3)^3), x)
```

# CHAPTER 4

## Appendix



## 4.1 Listing of Grading functions

The following are the current version of the grading functions used for grading the quality of the antiderivative with reference to the optimal antiderivative included in the test suite.

There is a version for Maple and for Mathematica/Rubi. There is a version for grading Sympy and version for use with Sagemath.

The following are links to the current source code.

The following are the listings of source code of the grading functions.

### 4.1.1 Mathematica and Rubi grading function

```
(* Original version thanks to Albert Rich emailed on 03/21/2017 *)
(* ::Package:: *)

(* Nasser: April 7,2022. add second output which gives reason for the grade *)
(*                        Small rewrite of logic in main function to make it*)
(*                        match Maple's logic. No change in functionality otherwise*)

(* ::Subsection:: *)
(*GradeAntiderivative[result,optimal]*)


(* ::Text:: *)
(*If result and optimal are mathematical expressions, *)
(*         GradeAntiderivative[result,optimal] returns*)
```

```
(*  "F" if the result fails to integrate an expression that*)
(*      is integrable*)
(*  "C" if result involves higher level functions than necessary*)
(*  "B" if result is more than twice the size of the optimal*)
(*      antiderivative*)
(*  "A" if result can be considered optimal*)


GradeAntiderivative[result_,optimal_] := Module[{expnResult,expnOptimal,leafCountResult,leafC
    expnResult  = ExpnType[result];
    expnOptimal = ExpnType[optimal];
    leafCountResult = LeafCount[result];
    leafCountOptimal = LeafCount[optimal];

    (*Print["expnResult=",expnResult," expnOptimal=",expnOptimal];*)
    If[expnResult<=expnOptimal,
        If[Not[FreeQ[result,Complex]], (*result contains complex*)
            If[Not[FreeQ[optimal,Complex]], (*optimal contains complex*)
                If[leafCountResult<=2*leafCountOptimal,
                    finalresult={"A"," "}
                    ,(*ELSE*)
                    finalresult={"B","Both result and optimal contain complex but leaf count
                ]
            ,(*ELSE*)
                finalresult={"C","Result contains complex when optimal does not."}
            ]
        ,(*ELSE*)(*result does not contains complex*)
            If[leafCountResult<=2*leafCountOptimal,
               finalresult={"A"," "}
            ,(*ELSE*)
               finalresult={"B","Leaf count is larger than twice the leaf count of optimal. $
              ]
        ]
    ,(*ELSE*) (*expnResult>expnOptimal*)
        If[FreeQ[result,Integrate] && FreeQ[result,Int],
            finalresult={"C","Result contains higher order function than in optimal. Order "<
            ,
            finalresult={"F","Contains unresolved integral."}
        ]
    ];

    finalresult
]
```

```
(* ::Text:: *)
(*The following summarizes the type number assigned an *)
(*expression based on the functions it involves*)
(*1 = rational function*)
(*2 = algebraic function*)
(*3 = elementary function*)
(*4 = special function*)
(*5 = hyperpergeometric function*)
(*6 = appell function*)
(*7 = rootsum function*)
(*8 = integrate function*)
(*9 = unknown function*)


ExpnType[expn_] :=
  If[AtomQ[expn],
    1,
  If[ListQ[expn],
    Max[Map[ExpnType,expn]],
  If[Head[expn]===Power,
    If[IntegerQ[expn[[2]]],
      ExpnType[expn[[1]]],
    If[Head[expn[[2]]]===Rational,
      If[IntegerQ[expn[[1]]] || Head[expn[[1]]]===Rational,
        1,
      Max[ExpnType[expn[[1]]],2]],
    Max[ExpnType[expn[[1]]],ExpnType[expn[[2]]],3]]],
  If[Head[expn]===Plus || Head[expn]===Times,
    Max[ExpnType[First[expn]],ExpnType[Rest[expn]]],
  If[ElementaryFunctionQ[Head[expn]],
    Max[3,ExpnType[expn[[1]]]],
  If[SpecialFunctionQ[Head[expn]],
    Apply[Max,Append[Map[ExpnType,Apply[List,expn]],4]],
  If[HypergeometricFunctionQ[Head[expn]],
    Apply[Max,Append[Map[ExpnType,Apply[List,expn]],5]],
  If[AppellFunctionQ[Head[expn]],
    Apply[Max,Append[Map[ExpnType,Apply[List,expn]],6]],
  If[Head[expn]===RootSum,
    Apply[Max,Append[Map[ExpnType,Apply[List,expn]],7]],
  If[Head[expn]===Integrate || Head[expn]===Int,
    Apply[Max,Append[Map[ExpnType,Apply[List,expn]],8]],
  9]]]]]]]]]]
```

```
ElementaryFunctionQ[func_] :=
  MemberQ[{
  Exp,Log,
  Sin,Cos,Tan,Cot,Sec,Csc,
  ArcSin,ArcCos,ArcTan,ArcCot,ArcSec,ArcCsc,
  Sinh,Cosh,Tanh,Coth,Sech,Csch,
  ArcSinh,ArcCosh,ArcTanh,ArcCoth,ArcSech,ArcCsch
},func]


SpecialFunctionQ[func_] :=
  MemberQ[{
  Erf, Erfc, Erfi,
  FresnelS, FresnelC,
  ExpIntegralE, ExpIntegralEi, LogIntegral,
  SinIntegral, CosIntegral, SinhIntegral, CoshIntegral,
  Gamma, LogGamma, PolyGamma,
  Zeta, PolyLog, ProductLog,
  EllipticF, EllipticE, EllipticPi
},func]


HypergeometricFunctionQ[func_] :=
  MemberQ[{Hypergeometric1F1,Hypergeometric2F1,HypergeometricPFQ},func]


AppellFunctionQ[func_] :=
  MemberQ[{AppellF1},func]
```

### 4.1.2 Maple grading function

```
# File: GradeAntiderivative.mpl
# Original version thanks to Albert Rich emailed on 03/21/2017

#Nasser 03/22/2017  Use Maple leaf count instead since buildin
#Nasser 03/23/2017  missing 'ln' for ElementaryFunctionQ added
#Nasser 03/24/2017  corrected the check for complex result
#Nasser 10/27/2017  check for leafsize and do not call ExpnType()
#                   if leaf size is "too large". Set at 500,000
```

```
#Nasser 12/22/2019  Added debug flag, added 'dilog' to special functions
#                   see problem 156, file Apostol_Problems
#Nasser 4/07/2022   add second output which gives reason for the grade

GradeAntiderivative := proc(result,optimal)
local leaf_count_result,
        leaf_count_optimal,
        ExpnType_result,
        ExpnType_optimal,
        debug:=false;

        leaf_count_result:=leafcount(result);
        #do NOT call ExpnType() if leaf size is too large. Recursion problem
        if leaf_count_result > 500000 then
            return "B","result has leaf size over 500,000. Avoiding possible recursion issues
        fi;

        leaf_count_optimal := leafcount(optimal);
        ExpnType_result  := ExpnType(result);
        ExpnType_optimal := ExpnType(optimal);

        if debug then
            print("ExpnType_result",ExpnType_result," ExpnType_optimal=",ExpnType_optimal);
        fi;

# If result and optimal are mathematical expressions,
#  GradeAntiderivative[result,optimal] returns
#   "F" if the result fails to integrate an expression that
#       is integrable
#   "C" if result involves higher level functions than necessary
#   "B" if result is more than twice the size of the optimal
#       antiderivative
#   "A" if result can be considered optimal

    #This check below actually is not needed, since I only
    #call this grading only for passed integrals. i.e. I check
    #for "F" before calling this. But no harm of keeping it here.
    #just in case.


    if not type(result,freeof('int')) then
        return "F","Result contains unresolved integral";
    fi;
```

```
if ExpnType_result<=ExpnType_optimal then
    if debug then
         print("ExpnType_result<=ExpnType_optimal");
    fi;
    if is_contains_complex(result) then
        if is_contains_complex(optimal) then
            if debug then
                    print("both result and optimal complex");
            fi;
            if leaf_count_result<=2*leaf_count_optimal then
                return "A"," ";
            else
               return "B",cat("Both result and optimal contain complex but leaf count of
                               convert(leaf_count_result,string)," vs. $2 (",
                               convert(leaf_count_optimal,string)," ) = ",convert(2*leaf_
            end if
        else #result contains complex but optimal is not
            if debug then
                    print("result contains complex but optimal is not");
            fi;
            return "C","Result contains complex when optimal does not.";
        fi;
    else # result do not contain complex
         # this assumes optimal do not as well. No check is needed here.
        if debug then
               print("result do not contain complex, this assumes optimal do not as well"
        fi;
        if leaf_count_result<=2*leaf_count_optimal then
            if debug then
                print("leaf_count_result<=2*leaf_count_optimal");
            fi;
            return "A"," ";
        else
            if debug then
                print("leaf_count_result>2*leaf_count_optimal");
            fi;
            return "B",cat("Leaf count of result is larger than twice the leaf count of o
                               convert(leaf_count_result,string),"$ vs. $2(",
                               convert(leaf_count_optimal,string),")=",convert(2*leaf_cou
        fi;
    fi;
```

```
    else #ExpnType(result) > ExpnType(optimal)
        if debug then
            print("ExpnType(result) > ExpnType(optimal)");
        fi;
        return "C",cat("Result contains higher order function than in optimal. Order ",
                       convert(ExpnType_result,string)," vs. order ",
                       convert(ExpnType_optimal,string),".");
    fi;

end proc:

#
# is_contains_complex(result)
# takes expressions and returns true if it contains "I" else false
#
#Nasser 032417
is_contains_complex:= proc(expression)
  return (has(expression,I));
end proc:

# The following summarizes the type number assigned an expression
# based on the functions it involves
# 1 = rational function
# 2 = algebraic function
# 3 = elementary function
# 4 = special function
# 5 = hyperpergeometric function
# 6 = appell function
# 7 = rootsum function
# 8 = integrate function
# 9 = unknown function

ExpnType := proc(expn)
  if type(expn,'atomic') then
    1
  elif type(expn,'list') then
    apply(max,map(ExpnType,expn))
  elif type(expn,'sqrt') then
    if type(op(1,expn),'rational') then
       1
    else
       max(2,ExpnType(op(1,expn)))
    end if
```

```
  elif type(expn,'`^`') then
    if type(op(2,expn),'integer') then
      ExpnType(op(1,expn))
    elif type(op(2,expn),'rational') then
      if type(op(1,expn),'rational') then
         1
      else
         max(2,ExpnType(op(1,expn)))
      end if
    else
         max(3,ExpnType(op(1,expn)),ExpnType(op(2,expn)))
    end if
  elif type(expn,'`+`') or type(expn,'`*`') then
    max(ExpnType(op(1,expn)),max(ExpnType(rest(expn))))
  elif ElementaryFunctionQ(op(0,expn)) then
    max(3,ExpnType(op(1,expn)))
  elif SpecialFunctionQ(op(0,expn)) then
    max(4,apply(max,map(ExpnType,[op(expn)])))
  elif HypergeometricFunctionQ(op(0,expn)) then
    max(5,apply(max,map(ExpnType,[op(expn)])))
  elif AppellFunctionQ(op(0,expn)) then
    max(6,apply(max,map(ExpnType,[op(expn)])))
  elif op(0,expn)='int' then
    max(8,apply(max,map(ExpnType,[op(expn)]))) else
  9
  end if
end proc:


ElementaryFunctionQ := proc(func)
  member(func,[
        exp,log,ln,
        sin,cos,tan,cot,sec,csc,
        arcsin,arccos,arctan,arccot,arcsec,arccsc,
        sinh,cosh,tanh,coth,sech,csch,
        arcsinh,arccosh,arctanh,arccoth,arcsech,arccsch])
end proc:

SpecialFunctionQ := proc(func)
  member(func,[
        erf,erfc,erfi,
        FresnelS,FresnelC,
        Ei,Ei,Li,Si,Ci,Shi,Chi,
```

```
        GAMMA,lnGAMMA,Psi,Zeta,polylog,dilog,LambertW,
        EllipticF,EllipticE,EllipticPi])
end proc:

HypergeometricFunctionQ := proc(func)
  member(func,[Hypergeometric1F1,hypergeom,HypergeometricPFQ])
end proc:

AppellFunctionQ := proc(func)
  member(func,[AppellF1])
end proc:

# u is a sum or product.  rest(u) returns all but the
# first term or factor of u.
rest := proc(u) local v;
  if nops(u)=2 then
     op(2,u)
  else
     apply(op(0,u),op(2..nops(u),u))
  end if
end proc:

#leafcount(u) returns the number of nodes in u.
#Nasser 3/23/17  Replaced by build-in leafCount from package in Maple
leafcount := proc(u)
   MmaTranslator[Mma][LeafCount](u);
end proc:
```

### 4.1.3 Sympy grading function

```
#Dec 24, 2019. Nasser M. Abbasi:
#              Port of original Maple grading function by
#              Albert Rich to use with Sympy/Python
#Dec 27, 2019  Nasser. Added `RootSum`. See problem 177, Timofeev file
#              added 'exp_polar'
from sympy import *

def leaf_count(expr):
    #sympy do not have leaf count function. This is approximation
    return round(1.7*count_ops(expr))

def is_sqrt(expr):
```

```
    if isinstance(expr,Pow):
        if expr.args[1] == Rational(1,2):
            return True
        else:
            return False
    else:
        return False

def is_elementary_function(func):
    return func in [exp,log,ln,sin,cos,tan,cot,sec,csc,
            asin,acos,atan,acot,asec,acsc,sinh,cosh,tanh,coth,sech,csch,
            asinh,acosh,atanh,acoth,asech,acsch
        ]

def is_special_function(func):
    return func in [ erf,erfc,erfi,
             fresnels,fresnelc,Ei,Ei,Li,Si,Ci,Shi,Chi,
             gamma,loggamma,digamma,zeta,polylog,LambertW,
             elliptic_f,elliptic_e,elliptic_pi,exp_polar
         ]

def is_hypergeometric_function(func):
    return func in [hyper]

def is_appell_function(func):
    return func in [appellf1]

def is_atom(expn):
    try:
        if expn.isAtom or isinstance(expn,int) or isinstance(expn,float):
          return True
        else:
          return False

    except AttributeError as error:
        return False

def expnType(expn):
    debug=False
    if debug:
        print("expn=",expn,"type(expn)=",type(expn))

    if is_atom(expn):
```

```
        return 1
    elif isinstance(expn,list):
        return max(map(expnType, expn))    #apply(max,map(ExpnType,expn))
    elif is_sqrt(expn):
        if isinstance(expn.args[0],Rational): #type(op(1,expn),'rational')
            return 1
        else:
            return max(2,expnType(expn.args[0]))  #max(2,ExpnType(op(1,expn)))
    elif isinstance(expn,Pow):   #type(expn,'`^`')
        if isinstance(expn.args[1],Integer):  #type(op(2,expn),'integer')
            return expnType(expn.args[0])   #ExpnType(op(1,expn))
        elif isinstance(expn.args[1],Rational):  #type(op(2,expn),'rational')
            if isinstance(expn.args[0],Rational): #type(op(1,expn),'rational')
                return 1
            else:
                return max(2,expnType(expn.args[0]))  #max(2,ExpnType(op(1,expn)))
        else:
            return max(3,expnType(expn.args[0]),expnType(expn.args[1])) #max(3,ExpnType(op(1,expn)),ExpnT
    elif isinstance(expn,Add) or isinstance(expn,Mul): #type(expn,'`+`') or type(expn,'`*`')
        m1 = expnType(expn.args[0])
        m2 = expnType(list(expn.args[1:]))
        return max(m1,m2)  #max(ExpnType(op(1,expn)),max(ExpnType(rest(expn))))
    elif is_elementary_function(expn.func):  #ElementaryFunctionQ(op(0,expn))
        return max(3,expnType(expn.args[0]))  #max(3,ExpnType(op(1,expn)))
    elif is_special_function(expn.func): #SpecialFunctionQ(op(0,expn))
        m1 = max(map(expnType, list(expn.args)))
        return max(4,m1)    #max(4,apply(max,map(ExpnType,[op(expn)])))
    elif is_hypergeometric_function(expn.func): #HypergeometricFunctionQ(op(0,expn))
        m1 = max(map(expnType, list(expn.args)))
        return max(5,m1)    #max(5,apply(max,map(ExpnType,[op(expn)])))
    elif is_appell_function(expn.func):
        m1 = max(map(expnType, list(expn.args)))
        return max(6,m1)    #max(5,apply(max,map(ExpnType,[op(expn)])))
    elif isinstance(expn,RootSum):
        m1 = max(map(expnType, list(expn.args))) #Apply[Max,Append[Map[ExpnType,Apply[List,expn]],7]],
        return max(7,m1)
    elif str(expn).find("Integral") != -1:
        m1 = max(map(expnType, list(expn.args)))
        return max(8,m1)    #max(5,apply(max,map(ExpnType,[op(expn)])))
    else:
        return 9

#main function
```

```
def grade_antiderivative(result,optimal):

    #print ("Enter grade_antiderivative for sagemath")
    #print("Enter grade_antiderivative, result=",result," optimal=",optimal)

    leaf_count_result  = leaf_count(result)
    leaf_count_optimal = leaf_count(optimal)

    #print("leaf_count_result=",leaf_count_result)
    #print("leaf_count_optimal=",leaf_count_optimal)

    expnType_result  = expnType(result)
    expnType_optimal = expnType(optimal)

    if str(result).find("Integral") != -1:
        grade = "F"
        grade_annotation =""
    else:
        if expnType_result <= expnType_optimal:
            if result.has(I):
                if optimal.has(I): #both result and optimal complex
                    if leaf_count_result <= 2*leaf_count_optimal:
                        grade = "A"
                        grade_annotation =""
                    else:
                        grade = "B"
                        grade_annotation ="Both result and optimal contain complex but leaf count of result is large
                else: #result contains complex but optimal is not
                    grade = "C"
                    grade_annotation ="Result contains complex when optimal does not."
            else: # result do not contain complex, this assumes optimal do not as well
                if leaf_count_result <= 2*leaf_count_optimal:
                    grade = "A"
                    grade_annotation =""
                else:
                    grade = "B"
                    grade_annotation ="Leaf count of result is larger than twice the leaf count of optimal. "+str(le
        else:
            grade = "C"
            grade_annotation ="Result contains higher order function than in optimal. Order "+str(ExpnType_


    #print("Before returning. grade=",grade, " grade_annotation=",grade_annotation)
```

```
    return grade, grade_annotation
```

### 4.1.4 SageMath grading function

```
#Dec 24, 2019. Nasser: Ported original Maple grading function by
#              Albert Rich to use with Sagemath. This is used to
#              grade Fricas, Giac and Maxima results.
#Dec 24, 2019. Nasser: Added 'exp_integral_e' and 'sng', 'sin_integral'
#              'arctan2','floor','abs','log_integral'
#June 4, 2022  Made default grade_annotation "none" instead of "" due
#              issue later when reading the file.
#July 14, 2022. Added ellipticF. This is until they fix sagemath, then remove it.

from sage.all import *
from sage.symbolic.operators import add_vararg, mul_vararg

debug=False;

def tree_size(expr):
    r"""
    Return the tree size of this expression.
    """
    #print("Enter tree_size, expr is ",expr)

    if expr not in SR:
        # deal with lists, tuples, vectors
        return 1 + sum(tree_size(a) for a in expr)
    expr = SR(expr)
    x, aa = expr.operator(), expr.operands()
    if x is None:
        return 1
    else:
        return 1 + sum(tree_size(a) for a in aa)

def is_sqrt(expr):
    if expr.operator() == operator.pow:   #isinstance(expr,Pow):
        if expr.operands()[1]==1/2: #expr.args[1] == Rational(1,2):
            if debug: print ("expr is sqrt")
            return True
        else:
```

```
            return False
    else:
        return False

def is_elementary_function(func):
    #debug=False
    m = func.name() in ['exp','log','ln',
            'sin','cos','tan','cot','sec','csc',
            'arcsin','arccos','arctan','arccot','arcsec','arccsc',
            'sinh','cosh','tanh','coth','sech','csch',
            'arcsinh','arccosh','arctanh','arccoth','arcsech','arccsch','sgn',
        'arctan2','floor','abs'
        ]
    if debug:
        if m:
            print ("func ", func , " is elementary_function")
        else:
            print ("func ", func , " is NOT elementary_function")


    return m

def is_special_function(func):
    #debug=False
    if debug:
        print ("type(func)=", type(func))

    m= func.name() in ['erf','erfc','erfi','fresnel_sin','fresnel_cos','Ei',
          'Ei','Li','Si','sin_integral','Ci','cos_integral','Shi','sinh_integral'
          'Chi','cosh_integral','gamma','log_gamma','psi,zeta',
          'polylog','lambert_w','elliptic_f','elliptic_e','ellipticF',
          'elliptic_pi','exp_integral_e','log_integral']

    if debug:
        print ("m=",m)
        if m:
            print ("func ", func ," is special_function")
        else:
            print ("func ", func ," is NOT special_function")


    return m
```

```
def is_hypergeometric_function(func):
   return func.name() in ['hypergeometric','hypergeometric_M','hypergeometric_U']

def is_appell_function(func):
   return func.name() in ['hypergeometric']   #[appellf1] can't find this in sagemath

def is_atom(expn):

   #debug=False
   if debug:
       print ("Enter is_atom, expn=",expn)

   if not hasattr(expn, 'parent'):
      return False


   #thanks to answer at https://ask.sagemath.org/question/49179/what-is-sagemath-equivalent-to-atomic-
   try:
      if expn.parent() is SR:
         return expn.operator() is None
      if expn.parent() in (ZZ, QQ, AA, QQbar):
         return expn in expn.parent() # Should always return True
      if hasattr(expn.parent(),"base_ring") and hasattr(expn.parent(),"gens"):
         return expn in expn.parent().base_ring() or expn in expn.parent().gens()

      return False

   except AttributeError as error:
      print("Exception,AttributeError in  is_atom")
      print ("cought exception" , type(error).__name__ )
      return False


def expnType(expn):

   if debug:
      print (">>>>>Enter expnType, expn=", expn)
      print (">>>>>is_atom(expn)=", is_atom(expn))

   if is_atom(expn):
      return 1
   elif type(expn)==list:   #isinstance(expn,list):
```

```
        return max(map(expnType, expn))    #apply(max,map(ExpnType,expn))
    elif is_sqrt(expn):
        if type(expn.operands()[0])==Rational: #type(isinstance(expn.args[0],Rational):
            return 1
        else:
            return max(2,expnType(expn.operands()[0]))  #max(2,expnType(expn.args[0]))
    elif expn.operator() == operator.pow:   #isinstance(expn,Pow)
        if type(expn.operands()[1])==Integer:  #isinstance(expn.args[1],Integer)
            return expnType(expn.operands()[0])   #expnType(expn.args[0])
        elif type(expn.operands()[1])==Rational:  #isinstance(expn.args[1],Rational)
            if type(expn.operands()[0])==Rational: #isinstance(expn.args[0],Rational)
                return 1
            else:
                return max(2,expnType(expn.operands()[0]))  #max(2,expnType(expn.args[0]))
        else:
            return max(3,expnType(expn.operands()[0]),expnType(expn.operands()[1])) #max(3,expnType(expn.
    elif expn.operator() == add_vararg or expn.operator() == mul_vararg: #isinstance(expn,Add) or isinst
        m1 = expnType(expn.operands()[0]) #expnType(expn.args[0])
        m2 = expnType(expn.operands()[1:]) #expnType(list(expn.args[1:]))
        return max(m1,m2)  #max(ExpnType(op(1,expn)),max(ExpnType(rest(expn))))
    elif is_elementary_function(expn.operator()):  #is_elementary_function(expn.func)
        return max(3,expnType(expn.operands()[0]))
    elif is_special_function(expn.operator()): #is_special_function(expn.func)
        m1 = max(map(expnType, expn.operands()))      #max(map(expnType, list(expn.args)))
        return max(4,m1)   #max(4,m1)
    elif is_hypergeometric_function(expn.operator()): #is_hypergeometric_function(expn.func)
        m1 = max(map(expnType, expn.operands()))      #max(map(expnType, list(expn.args)))
        return max(5,m1)   #max(5,m1)
    elif is_appell_function(expn.operator()):
        m1 = max(map(expnType, expn.operands()))      #max(map(expnType, list(expn.args)))
        return max(6,m1)   #max(6,m1)
    elif str(expn).find("Integral") != -1: #this will never happen, since it
                #is checked before calling the grading function that is passed.
                #but kept it here.
        m1 = max(map(expnType, expn.operands()))      #max(map(expnType, list(expn.args)))
        return max(8,m1)   #max(5,apply(max,map(ExpnType,[op(expn)])))
    else:
        return 9

#main function
def grade_antiderivative(result,optimal):
```

```
    if debug:
        print ("Enter grade_antiderivative for sagemath")
        print("Enter grade_antiderivative, result=",result)
        print("Enter grade_antiderivative, optimal=",optimal)
        print("type(anti)=",type(result))
        print("type(optimal)=",type(optimal))

    leaf_count_result  = tree_size(result) #leaf_count(result)
    leaf_count_optimal = tree_size(optimal) #leaf_count(optimal)

    #if debug: print ("leaf_count_result=", leaf_count_result, "leaf_count_optimal=",leaf_count_optimal)


    expnType_result  = expnType(result)
    expnType_optimal = expnType(optimal)

    if debug: print ("expnType_result=", expnType_result, "expnType_optimal=",expnType_optimal)

    if expnType_result <= expnType_optimal:
        if result.has(I):
            if optimal.has(I): #both result and optimal complex
                if leaf_count_result <= 2*leaf_count_optimal:
                    grade = "A"
                    grade_annotation =" "
                else:
                    grade = "B"
                    grade_annotation ="Both result and optimal contain complex but leaf count of result is larger t
            else: #result contains complex but optimal is not
                grade = "C"
                grade_annotation ="Result contains complex when optimal does not."
        else: # result do not contain complex, this assumes optimal do not as well
            if leaf_count_result <= 2*leaf_count_optimal:
                grade = "A"
                grade_annotation =" "
            else:
                grade = "B"
                grade_annotation ="Leaf count of result is larger than twice the leaf count of optimal. "+str(leaf_
    else:
        grade = "C"
        grade_annotation ="Result contains higher order function than in optimal. Order "+str(expnType_resu


    print("Before returning. grade=",grade, " grade_annotation=",grade_annotation)
```

```
    return grade, grade_annotation
```